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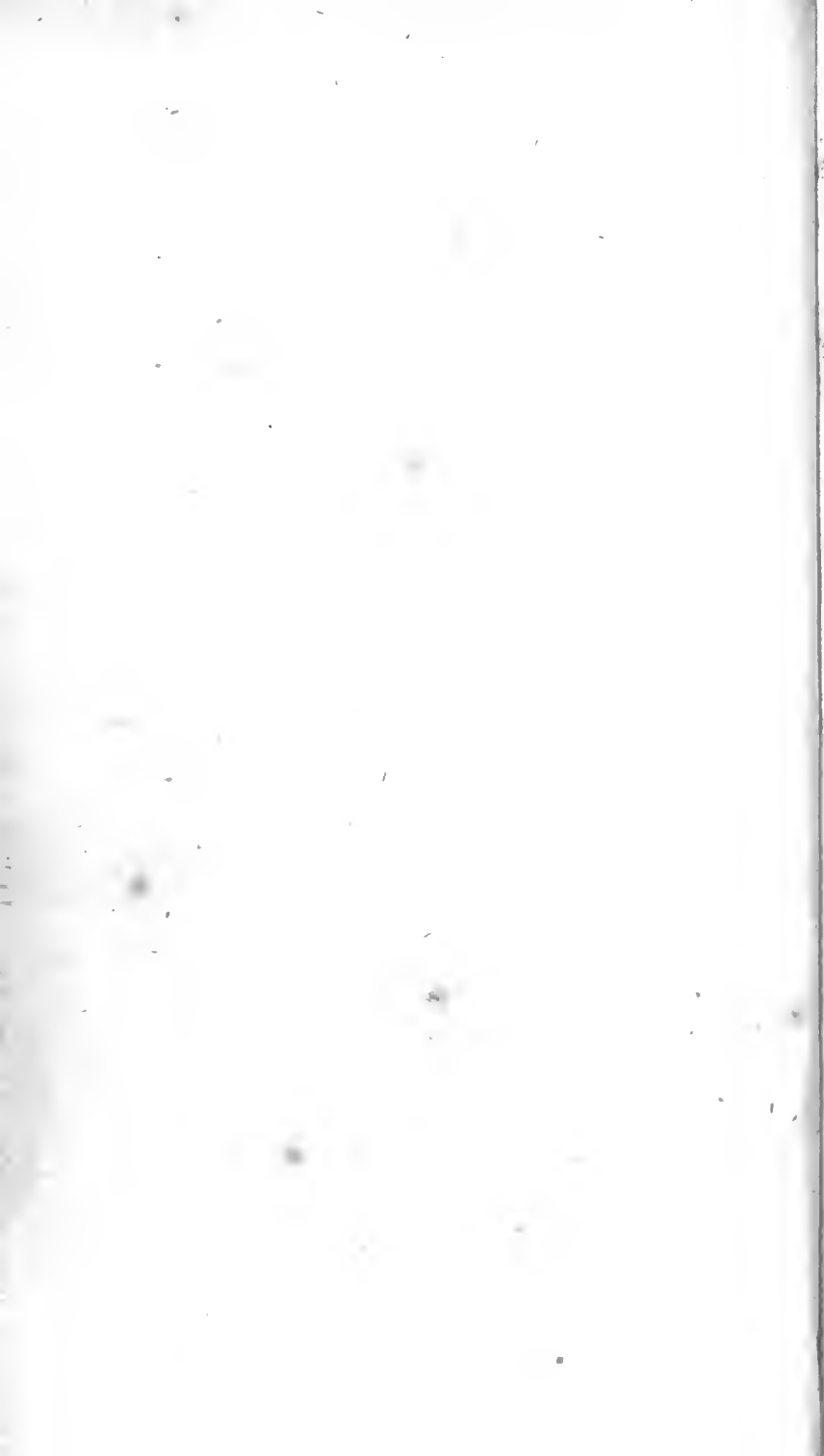
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A NEW SYSTEM
OF THE
NATURAL HISTORY
OF
FISHES AND INSECTS.

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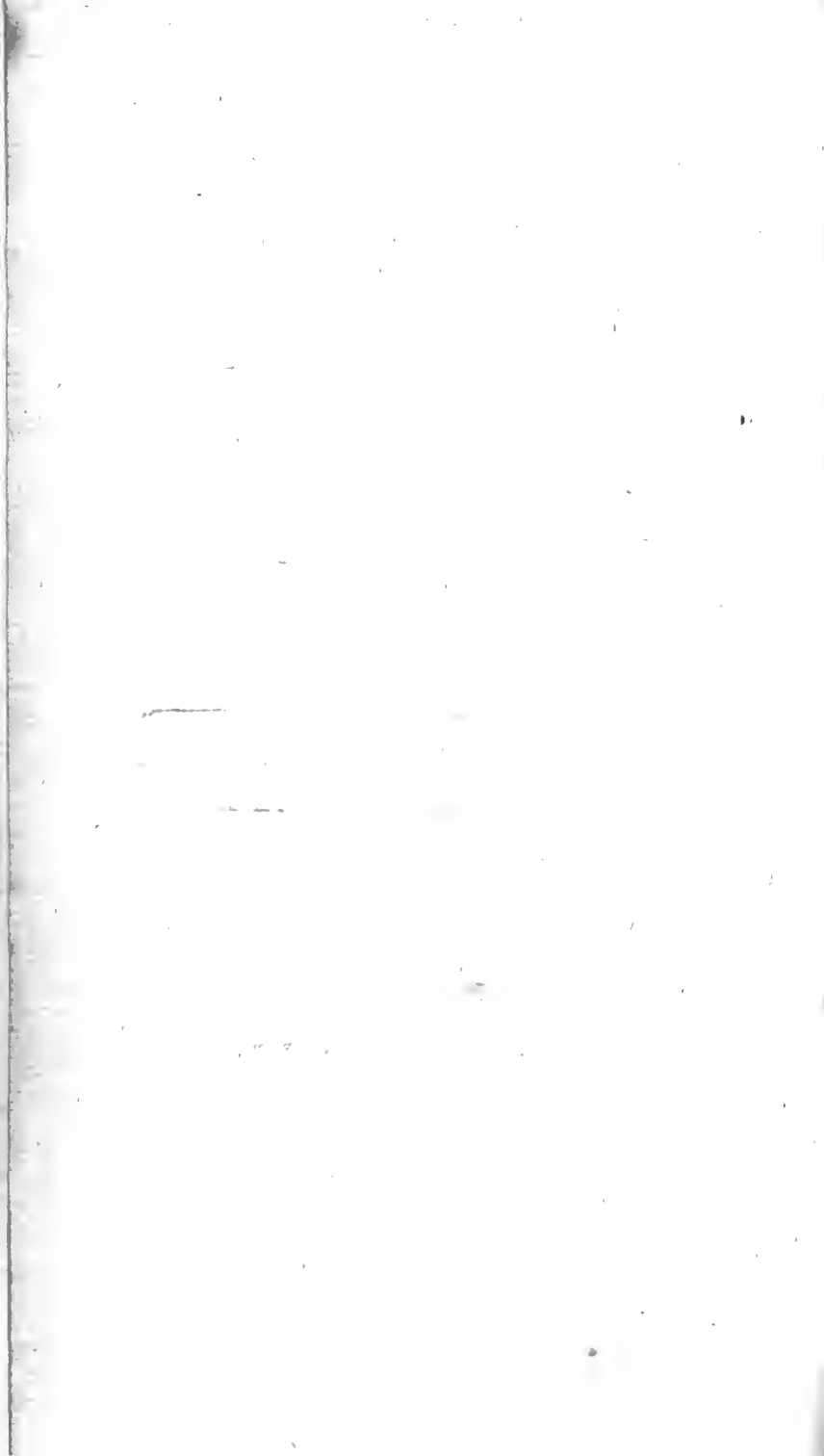
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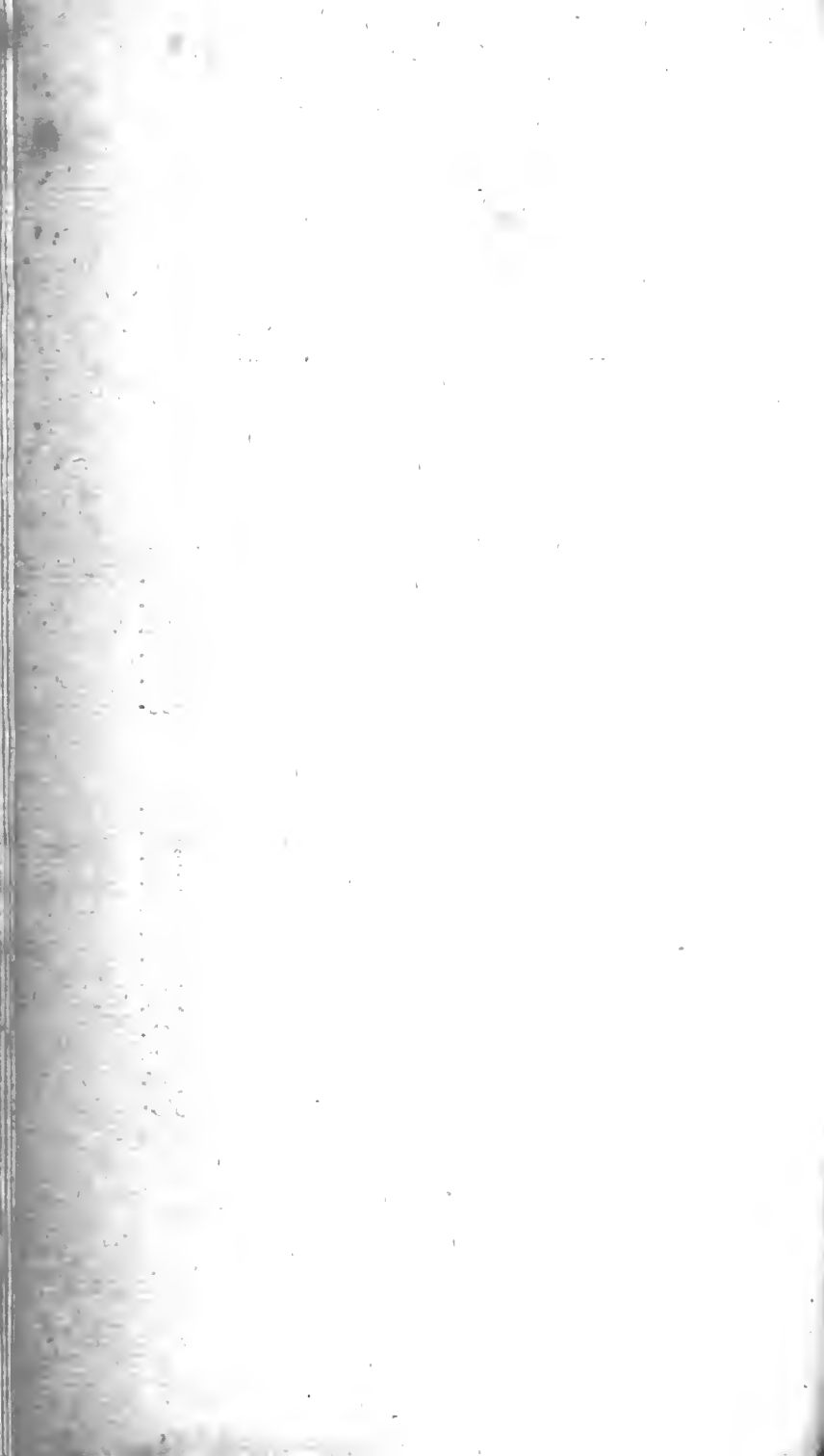
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NATURAL HISTORY

OF

FISHES.

CHAPTER I. OF FISHES IN GENERAL.

SECT. I.—*History of Ichthyology.*

IN the early periods of society, the necessities and wants of men, rather than their curiosity, prompt them to pay attention to the different objects, which the munificent Author of nature has placed around them: And, though fishes constitute a greater part of the subsistence of men, in their rude and savage state, than perhaps in any future stage of their political existence, yet their acquaintance with this part of the animal kingdom, in the earlier ages of society, is by no means extensive. A few species that are most common, or most easily taken in the nearest river or lake, are all that the necessity of the savage requires; and, as in him, curiosity has not yet begun to be a steady principle of action, it seldom leads him to examine more.

Even after nations have attained to some degree of knowledge and civilization, many ages elapse before they push their inquiries far into the subject of ichthyology, or acquire any considerable acquaintance with the inhabitants of the ocean. In the unfathomed depths of that turbulent and extensive element, probably millions reside, of which the far greater part are secluded from human observation; and, even of the few which the industry of man has, at last, drawn from their hidden abode, we hardly know any thing, but the external figure, and the names. Their food, their longevity, their method of propagating their kind, and the whole of their manners and economy, remain still among those numberless secrets of Nature, which human ingenuity has not hitherto been able to explore. Hence, the natural history of fishes has seldom been found interesting, because it is destitute of that information, which it is the province of history to convey. It is more imperfect and obscure, than that of quadrupeds and birds, in proportion as the element, in which fishes reside, is more extensive and inaccessible.

Before the *Christian* era, few writers had turned their attention to this difficult branch of Natural History. *Aristotle*, *Theophrastus*, *Strabo*, and *Terentius Varro*, had made their observations on such as were then known; but they had scarcely any idea of treating the subject in a scientific manner. After that period, *Appian*, *Ovid* and *Columella*, described the fishes of the *Euxine* and *Adriatic* seas, as far as they had access to examine them. *Pliny* was the last, and by far the most copious writer upon this subject, among the ancients. He is, indeed, too diffuse; while his credulity and love of the marvellous, considerably weaken the authority of his narrative. An hundred and twenty-four species,

were

were all that the assiduity of the ancient naturalists had discovered.

During the decline and fall of the *Roman* empire, attention to ichthyology, as well as to every other part of literature, was entirely laid aside; nor did the pernicious effects of the *Gothic* invasions, allow it to be resumed, till the year 1524, when *Paulus Jovias**, an *Italian* writer, gave an account of those fishes, that were known to the ancient *Romans*. After him, various local historians appeared. *Belonius* and *Rondeletius* succeeded each other in describing the fishes of the *Mediterranean*; while *Swinfield*, *Marcgrave*, and *Catesby*, gave, successively, an account of the fishes of *Silesia*, *Brazil*, and the *Carolinas*.

While ichthyology was thus enriched by historians of particular districts, there were other naturalists, who engaged in this science in a more general and systematic manner. The Honourable *Francis Willoughby* published, in 1686, a history of fishes, which is still deemed one of the most valuable upon this subject. He was afterwards followed by *Artedis* and *Linnaeus*, who carried the science to a greater degree of perfection, than it had ever hitherto attained.

If we take into account the vast number of fishes, of which the very names have not yet found a place in the systems of naturalists, we must necessarily conclude, that this part of science, is still in its infancy. Some very skilful ichthyologists assert, that there are to be found in the different collections of fishes about *London*, six hundred kinds not enumerated by *Linnaeus*; and we may, perhaps, easily admit, that there are yet, in the unfathomable depths of the ocean, at least an equal num-

A 2

ber,

* *De piscibus Romanis.*

ber, that have not come into the possession of the curious.

It is remarkable, that there is no system of ichthyology in the *English* language. *Goldsmith's* plan did not admit of any thing more, than a general sketch of this subject. Accordingly, he has not described, perhaps, a twentieth part of those, that are already found in the systems of *Artedi* or *Linnaeus*. *Pennant* has, indeed, given a correct and elegant history of the *British* fishes; but these make only a small part of the inhabitants of the ocean. We dare not promise, in the narrow limits of the following work, to offer a complete system to the public. All the genera, however, are included, and a few of the most remarkable species belonging to each, are selected for a particular description.

By the labours, however, of the different philosophers already mentioned, nearly five hundred kinds of fishes have been enumerated, and described; and, in appearance at least, considerable progress has been made in explaining their history: But, unfortunately, the names and external figure of many of these are all that we know. Their food, migrations, manner of life, and every quality that can render their history interesting, still remain to be explored. While, therefore, we are guided principally by the arrangement of *Linnaeus*, in giving the following account of fishes, we will spare our readers the trouble of perusing the tedious catalogue, as often as it presents nothing, but the dry detail of names. We shall thus secure ourselves an opportunity of enlarging more fully upon those particular fishes, whose history may appear most authentic, curious, or useful.

Aristotle, that great father of naturalists, first suggested the excellent arrangement of fishes, into the *cetaceous*,
cartilaginous,

cartilaginous, and *spinous*. *; which, as far as it goes, seems impossible to be altered for the better †. *Rondeletius*, the first naturalist, who, after the revival of learning, turned his attention to this subject, attempted to lay aside the *Aristotelian* division, and to substitute, in its room, another, founded upon the habitation of fishes, or those places where they reside. He, accordingly, classed them into the fishes of the *sea*, *rivers* and *lakes* ‡. Since, however, many fishes reside indiscriminately in all these situations, this method was abandoned by *Willoughby* and *Ray*, who again resumed the arrangement of *Aristotle*; and, the celebrated *Linnaeus* has added to it some farther subdivisions, which render it still more useful.

The *cetaceous* fishes have, in the later editions of his works, been classed among the quadrupeds; the *cartilaginous* have been referred to the amphibious tribes, among which they constitute a particular order §; while the *spinous* or *bony*, are alone allowed to retain the name of *fishes*.

As we have already hinted, that we are to pass by, or but slightly mention, some species enumerated by that naturalist, whose manners are not interesting, or but imperfectly known; so, on the other hand, we shall restore to their natural station among the finny tribes, the *cetaceous* and *cartilaginous* fishes, which he has banished from that part of the animal kingdom.

The grand classical characters, which nature has imprinted on the *cetaceous* order, will, in a philosophical view,

* Hist. Animal.

† The *first* comprehends the *whale* kind; the *second*, those whose fish is supported by *cartilages*; and the *third*, those whose muscles are supported by *spin.* or *bony matter*.

‡ *Marini*, *Fluviatiles*, and *Lacusfres*.

§ *Amphibia Nantia*, *Lin. Syst. Nat. Ed. 12.*

view, vindicate their arrangement among quadrupeds. Their internal structure agrees, in every respect, with that of the *mammalia quadrupedia* of *Linnaeus*; and their external conformation also is, in some parts, similar.

The cetaceous fishes are destitute of gills: They breathe by means of lungs, and, on that account, are obliged to rise frequently to the surface of the water for respiration*. They resemble land animals too in having warm blood; in being provided with external organs of generation; and in their manner of copulating and bringing forth their young, which they suckle, and protect with parental attachment. They have the power of uttering sounds†, such as of bellowing and making other noises; a faculty denied to the other inhabitants of the deep.

But notwithstanding this striking similarity between the cetaceous fishes, and the land animals, there are many other properties belonging to the former, which must determine us to rank them among fishes, where the general voice and language of men have always placed them. The *seals*, *manati* and *whales*, are evidently the steps, by which Nature proceeds from the one of these great families to the other: Here they approximate, and appear kindred tribes. In the last of these species of animals however, the great outlines and form of a fish predominate: It is entirely naked, or covered with a smooth skin; it lives wholly in the water, and has all the actions and habits of its aquatic neighbours‡.

It is with much greater confidence and facility, that we restore to their original station, the *cartilaginous* fishes;

* *Vide* British Zoology.

† *Blasie's* Anat. Animal. 288.

‡ *Vide* *Raii* Synop. Pisc.

fishes; because greater violence has been used in excluding them from it. They are by no means capable of living indiscriminately in the water and on shore, and, therefore, merit not the name of *amphibious*, which *Linnaeus* has assigned them. The single circumstance, by which that naturalist determined their rank in the animal kingdom, is the want of the *bony operculum*, or covering of the gills, which is common to the *spinous* fishes.

This last order, which alone he admits to be fishes, he has very properly subdivided into four different sections, the *apodal*, the *thoracic*, the *jugular*, and *abdominal*, fishes *. This arrangement is founded on the comparison of the ventral fins to the feet of land animals; and the particular situation of these fins with respect to the rest, determine the place, where each fish is to be ranked.

The *apodal* fishes, are such as want the ventral fins altogether, such as the *swordfish* and *eel*. In the *jugular*, the ventral fins are placed before the pectoral, as is exemplified in the *codfish* and *blenny*. The *thoracic* are distinguished by having the ventral fins placed beneath the pectoral, as is illustrated by the *mackerel*, or *father-lasher*. The *abdominal* fishes are known, by having the ventral fins placed behind the pectoral fins, near to the abdomen, as is the case in the *salmon* and *pike*. This division of fishes, according to the situation of their fins, is exceedingly judicious and natural. It first occurred to *Linnaeus*, when examining a collection of prepared subjects, in the presence of Dr. *Sollunder*, who witnessed the extasy of this indefatigable naturalist on making this discovery†.

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* *Vide* Systema Nat. p. 422.

† He used the exclamation of the Grecian mathematician *Archimides*, *Ευρηκα*.

SECTION II.

Of the external Parts and Motion of Fishes.

THE external form of the greater part of fishes, tends greatly to the ease and celerity of their motion. It is sharp at either end, and swelling towards the middle; and is modelled by nature after that shape, which we endeavour to imitate in those vessels, that are intended for the greatest despatch. Every human contrivance, however, falls far short of the rapidity of the natives of the sea. All the larger fishes can easily overtake the best constructed vessel while in full sail; and play around it, without any apparent effort.

The principal instrument of this great velocity in fishes, is the tail, aided by the strength and flexibility of the back-bone. The other fins are too small, slender, and flexible, compared with the weight of the animal, to impel it through the water with such vast rapidity and force. Their principal use is to direct and moderate the movement, communicated by the impulse of the tail. A fish, when deprived of these, and put into a pond, darts upwards, downwards, and laterally, with all its wonted velocity, but without being able to direct its course*. The ventral and dorsal fins, serve the purpose of keeping the fishes in an erect and perpendicular position; and, perhaps, the first contributes to raise or sink them in the water. The pectoral fins regulate and assist progressive motion. When swimming rapidly forward,

* Berelli apud Will. de motu anim.

ward, fishes can, by extending these, stop their motion, and produce *mora*; and, when swimming in a straight direction, they can, by folding either, while the other continues to ply, direct their motion to that side. The size of these fins, is, in general, proportioned to that of the head of the fish to which they belong; and it is probably one use of them, to prevent the fish from being overbalanced by the weight of its head, and precipitated to the bottom. In some fishes, the pectoral fins serve the same purpose as the wings of birds; for, by their means, they are enabled to rise from their watery element, and to fly for a considerable space, till their fins be so dried by the air, that, in spite of every exertion, they again sink into the water.

A fish completely equipped for swimming, has seven fins, two pairs, and three single ones; and of the latter, two are above, and one below: But, since those which have the greatest number of fins, are not the swiftest, it has been concluded, that the tail is the principal cause of the swiftness of a fish's motion. When in pursuit of its prey, or avoiding an enemy, all the smaller fins are laid close to its body; then, by the impulse of the tail alone, it skims through the water with the incredible velocity of a dart or an arrow*. The muscles, by which the tail is moved, are, by far, the thickest and strongest of the whole body; and to give direction to the great impetus which they communicate to the fish, seems to be the chief purpose of all the smaller fins.

The motion of fishes, is supposed to be assisted by the swimming bladder, which, by contraction and dilatation, serves to raise or sink them in the watery element at pleasure; and, as that element is of very different degrees

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* Willoughby Ichthyol. p. 4.

of weight, according to its depth, the fishes, by thus varying their specific gravity, can poise themselves in any part of it *. That this is the use of the air bladder, some naturalists pretend to have ascertained by experiment: An incision made into this organ, by which the air is allowed to escape, obliges the fishes, after some efforts, to sink to the bottom of the water. This opinion seems to receive confirmation from the manners of those kinds where it is wanting. All flounders and ground-fishes are destitute of a swimming bladder; and, by consequence, lie constantly at the bottom; while the cetaceous and cartilaginous orders, which often support themselves at the surface, without the aid of this instrument, are supplied with lungs, which serve the same purpose, by admitting the air, in much greater quantity, into the cavity of their bodies.

So far this matter seemed to be clear; but, upon examining this singular organ, it appeared to be supplied with no muscles that could enable the animal to contract or dilate it, in a voluntary manner. Two other opinions have, therefore, been formed concerning the use of the swimming bladder. Dr. *Needham* observed, that in the greater part of fishes, whether this organ was single, as in some species, or double, as in others, it was furnished with a duct or canal that opened into the stomach: Hence he concluded, that its use was to collect the air secreted from the blood, and to convey it into the stomach, where it assisted the process of digestion †. In this manner, he endeavoured to account for the extraordinary voracity of fishes, and their uncommon powers of digestion.

No

* Willoughbi Ichthyol. p. 13.

† De formato fœtu, ch. vi.

No philosopher seems yet to have made observations sufficiently accurate, fully to determine this matter; for it is not yet ascertained, whether the neck of the canal be supplied with a valve to emit air secreted from the blood, or to receive it from the stomach, or with a muscle that may equally serve to admit, or eject it: And what militates against *Needham's* opinion, is, that the cartilaginous fishes, which have nothing of this kind to aid their digestive powers, are as remarkable for voracity as any other kind.

The other use to which naturalists have destined this organ is, to serve as a receptacle for air, instead of the lungs in terrestrial animals, by which the necessities of these creatures may be supplied. The air bladder of fishes is confined in a triangular space at the upper part of the abdomen, and consists of one, two, and sometimes three divisions, all separated from the rest of the viscera by a thin membrane, attached, on each side, to the ribs: An apparatus of this kind, though we be not able to explain its use, no one can imagine was formed in vain. It is possible, that it may serve some purpose different from any of the above, and probably more than one even of these.

Fishes thus fitted for motion in their element, by their internal structure, as well as by their outward shape, and the situation of their fins, seem as well furnished with the means of happiness, as either quadrupeds or birds. Like these they are furnished with an external covering, to defend them from injuries in the turbulent fluid which they inhabit. That slimy and glutinous substance, which is secreted from the pores of all fishes, not only defends their bodies from accident, but is happily contrived to give little obstruction to their progress through the water. Besides this substance, which defends their bodies

from the immediate contact of the surrounding fluid, the greater part of fishes are provided with a strong covering of scales, which still more powerfully protects them from injury; and, beneath this, they are supplied with an oily matter, which preserves the body in warmth and vigour.

When, however, we examine the senses, and other faculties, of this part of the animal kingdom, we find it in a rank greatly below the other tribes; and that Nature having intended them for less perfect beings, has been sparing in her endowments. The brain, the seat of sensation, is much smaller in fishes, than in other animals; and, probably, gives off a smaller number of nerves to the different parts of the body*. Those strong teguments, with which we have observed that their bodies are covered, must greatly obstruct their sense of touch, which, in all probability, is far from being delicate.

The external organs of smell, and the nerves which supply them, are perceptible in the greater part of fishes; and, even where the apparatus is not discernable without, the formation of the bones within, plainly indicate an apparatus for this purpose. But as air is the only medium we know for the distribution of odours, it cannot be supposed, that these animals, residing in water, can be possessed of any capacity of being affected by them. If they have any perception of smells, it must be in the same manner as we distinguish by our taste; and it is probable, that the olfactory membrane in fishes, serves them instead of a distinguishing palate: By this they judge of substances, whose vapours, having tintured the water, are sent to their nostrils, and, no doubt, produce

* Willisius de anat. cerebri apud Willoubitum.

produce some kind of sensation. This, most probably, is the use of that organ in these animals; as, otherwise, they would be provided with the instruments of a sense, which they could not enjoy from want of an opportunity of using them *.

The sense of taste in fishes must be very imperfect, if its delicacy arise from the pliancy and softness of the organ. The whole mouth of fishes is covered with a hard bony substance, which must deprive them of almost all power of distinguishing different substances by the palate: Their voracity, accordingly, is so indiscriminate, that there is hardly any kind of food which they will not swallow: They devour the fisherman's plummet instead of the bait.

All fishes, except the cetaceous, are deprived, not only of external ears, but also of the auditory nerves and canal. Of the sense of hearing, therefore, it is probable, that they are altogether destitute†. As they are incapable of uttering sounds, they could seldom have an opportunity of hearing, even though Nature had endowed them with that power. They have no voice to communicate with each other, and, consequently, have no need of that organ by which it is discerned. The whales, and perhaps the cartilaginous fishes, are found possessed of small apertures for the admission of sounds; but, even in these, this sense must, from the smallness of the organ, be very imperfect.

Naturalists, determined by these reasons, seem, in general, agreed, that all the spinous fishes are destitute of the faculty of hearing. *Linnaeus* who has probably examined a greater number of subjects, and with more accuracy than any other philosopher, confesses, that he

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* Goldsmith's Nat. Hist. vol. 6. p. 160.

† *Ramus* apud Will. c. in lib. 1. de pisc. auditur.

has not been able to discover any auditory organs in this class of the animal kingdom*. Mr. *Klein*, however, imagines he has found out organs of this sense; and he has allotted for that purpose, those bones which are found in the head of some fishes†. But these are so dissimilar to the organs of hearing in other animals, that it is improbable, that Nature intended them for that purpose; and, besides, there are many species, in which they are not to be discovered.

But although Nature, in their conformation, had made a provision for the hearing of fishes, that sense must have been extremely limited and imperfect, from the nature of the element which they inhabit. Experiments have been made on the capacity of water to transmit sounds; and by these it has been found, that it is capable of conveying them but a short way; for it quickly deadens that vibration upon which they depend. A man whose head is one foot immersed in water, hears voices and words uttered in the air; but, when sunk to the depth of twelve feet, he scarcely hears a musket shot, though discharged over his head. Hence it is probable, that Nature has made no organic apparatus to convey sounds to fishes, since she has forever consigned them to an element, which must, in a great measure, have defecated its purpose.

Rondeletius ‡, and several of the old naturalists, who plead for the hearing of fishes, allege, in proof of it, that certain kinds of them are so affected with noise, that they become unwholesome after thunder; and that, in ponds where they are tamed, in some places of *Germany*, they are convened regularly by the call of a bell to their food.

* *Systema Naturæ.*

† *Vide Historiam Piscium.*

‡ *Rondel. de piscibus, lib. 7. cap. 14.*

food. But the experiments made by Mr. *Gorian* *, professor of medicine at *Montpelier*, clearly demonstrate the fallacy of these proofs. The gold fishes, which he kept in vases, he could never disturb by the loudest noise, provided he could prevent the tremor of the air from affecting the water. It appears, therefore, that fishes are as destitute of hearing as of voice; and that, when they appear to come to their food at the call of a bell or whistle, it is either by feeling the vibrations of the sound affect the water, or by seeing the persons approach by whom they are accustomed to be fed †.

The sight of fishes is probably the most perfect of all their senses, and yet it is far inferior to that of most other animals. They have, properly speaking, no eye-lids: Their sight is protected in the water by a nictating membrane, which is a continuation of the same transparent skin that covers the rest of the head. The crystalline humour, which in most other animals is flat, is in them convex, and round like a ball ‡. In consequence of this, these animals must be near-sighted, even in water, which, like a concave glass, corrects, in some degree, this defect of the organ of vision. We have no evidence of any fishes seeing at a considerable distance; and the case with many of them, that are deceived by the different kinds of bait prepared in imitation of their food, gives room to suspect, that objects are not very distinctly perceived by them, even when near.

From this short account of the external senses of fishes, it must appear, that their faculties, in point of perfection, fall greatly below those of the other tribes, which have already

* *Historia Pisc.*

† *Linnæi Systema Naturæ.*

‡ *Goldsmith's Nat. Hist. vol. vi.*

ready been reviewed in the preceding part of this work. In every thing resembling intelligence, their inferiority is equally striking. They are incapable of attachment, or of acquiring any new habits by domestication and intercourse with man. Some faint traces, indeed, of memory they discover, if it be true, as is alleged, that they regularly return to the place where they have been fed *; but even this small share of recollection, can hardly be allowed them without hesitation; for they may be assembled there, merely by seeing one of their number pick up the remains of the food which they had formerly left. It forms no exception to the general conclusion, that all their powers and faculties are of a subordinate kind, suited to that humble and passive existence which Nature has assigned them. To preserve existence, and to continue it to posterity, fill up the whole circle of their pursuits and enjoyments, to which they are impelled rather by necessity than choice. While they seem mechanically excited to every fruition, their senses are incapable of making any distinctions; and they are hurried forward in pursuit of whatever they can swallow, conquer, or enjoy †.

* Willoub. Hist. Piscium, cap. iii.

† Goldsmith, Nat. Hist. vol. vi. p. 164.

SECTION III.

Of the Respiration, Food, &c. of Fishes.

IN all animals, respiration, or the admission of air into the body, seems necessary to the support of life. From the experiments that have been made upon fishes, almost in the infancy of science, it appears, that they are incapable of subsisting without air for any considerable time. The cetaceous and cartilaginous fishes, are supplied with the necessary quantity of this fluid, by means of lungs like the terrestrial animals; and hence the *Swedish* naturalist has arranged them in the same class of beings *. In the spinous fishes, respiration is performed by *branchiæ*, or gills, without the cavity of the body; but the precise manner in which this operation is carried on, is one of those secrets of Nature, which neither the glasses nor the knife of the anatomist have ever yet been able to develop. The manner, indeed, in which the air is transmitted from the lungs of quadrupeds into the blood, is perhaps equally mysterious, as its passage from the *branchiæ* of fishes into the arteries leading to the heart. This difficulty *Artedi* confesses †; and *Rondeletius*, *Needham*, and other philosophers, have in vain endeavoured to explain it.

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* *Vide* Systema Naturæ, last edition.

† Quomodo aer intret branchias piscium, difficile est dictu.

The gills, it would appear, have a power of absorbing the air, without giving admission to the water which is received into the mouth, and ejected by the branchiæ, at each movement of the opercula which cover them; but in what manner the subtle separation is performed, no naturalist has ever ventured to declare. As the air and water pass quickly through the gills, without any apparent effort to separate them, it is probable, that only a small quantity of the former is absorbed, but that, by the frequent transition of the water, a sufficient quantity of it may be admitted to supply animals whose blood is naturally cold, and not in great abundance*.

But, however small a quantity of air may suffice to support the life of a fish, some portion of it is absolutely necessary to every living being. Some have been shut up in a narrow mouthed vessel, and have lived there for several years; but the air is no sooner excluded, by stopping up the opening, than the animals are suffocated in the course of a few minutes. When this experiment was repeated with the vessel filled half with water, and half with air, after covering the mouth, as the air below began to be exhausted, the fishes were seen struggling to rise above one another, and inhale a small supply at the surface of the water; and the same consequence will follow, if you fasten down the opercula of the gills with a string, so that respiration cannot be performed†. This probably is the cause why so many fishes are destroyed in rivers by severe frost: When, by the congelation of the whole surface of the water, the external air is excluded, the animals below must necessarily perish‡.

Aelian

* Willoughby, lib. i.

† Rondelct, lib. iv.

‡ Willoughby, cap. v.

Aelian mentions a method of taking fishes in the river *Ister*, founded upon this observation. In the rigour of winter, the fishermen broke small holes through the ice. The suffocating animals instantly crowded to the aperture, in order to procure a supply of air; and so eager were they to obtain it, that rather than abandon the attempt, they suffered themselves to be caught with the hand.

Next to the necessity of breathing air, that of devouring food seems to be the most constant and urgent in the nature of fishes. Among them this appetite, both in strength and avidity, seems to surpass those limits which Nature has prescribed to herself in the other orders of the animal kingdom. Every aquatic animal that has life, falls a victim to the indiscriminate voracity of one or other of the fishes. The smaller tribes devour insects, worms, or the spawn of the rest of the tenants of the waters; while they, in their turn, are pursued by millions larger and more rapacious than themselves. A few of them feed upon mud, the aquatic plants or grains of corn; but by far the greater numbers subsist upon animal food alone; and of this they are so voracious, that they spare not even those of their own kind*. *Charri* kept in a pond, if scantily supplied, frequently devour their own young. Others that are larger, go in quest of a larger prey; it matters not of what kind, whether of another species, or of their own. Those with the most capacious mouths, pursue almost every thing that has life, and often meet each other in fierce opposition, when the fish which has the widest throat comes off with victory, and devours its antagonist†.

Thus

* Willoughby, lib. i. cap. x.

† Goldsmith, Nat. Hist. vol. vi.

Thus the rapacious fishes are different from the predatory kinds of terrestrial animals; they are neither few in number, nor solitary in their habits. Their rapacity is not confined to a few species, one region of the sea, or individual efforts. Almost the whole order is continually irritated by the cravings of an appetite, the strength of which excites them to encounter every danger, and which, by its excess, often destroys that life which it was intended to prolong. Innumerable shoals of one species, pursue those of another through vast tracts of the ocean, from the vicinity of the pole, down to the equator. It is thus that the cod pursues the whiting, which flies before it, from the banks of *Newfoundland*, to the southern coasts of *Spain*. Thus too the cachalot drives whole armies of herrings from the regions of the north, devouring, at every instant, thousands in the rear. Hence, the life of every fish, from the smallest to the greatest, is but a continued scene of rapine; and every quarter of the immense ocean, presents one uniform picture of hostility, violence and invasion.

In this unceasing conflict, occasioned by the voracity of the different kinds of fishes, the smaller tribes must have, long since, fallen victims to the avidity of the larger; had not Nature skilfully proportioned the means of their escape, their numbers, and their productive powers, to the extent and variety of the dangers, to which they are continually exposed. To supply the constant waste, occasioned by their destruction in the unequal combat, they are not only more numerous and prolific, than the larger kinds; but, by a happy instinct are directed to seek for food and protection near the shore; where, from the shallowness of the water, their destroyers are unable to pursue them. These, yielding

to the strong impulse of hunger, become plunderers in their turn, and revenge the injuries committed on their kind, by destroying the spawn of the larger fishes, which they find floating upon the surface of the water *. Even there, however, they often meet with that violence which their own hostility merits; for the oyster, the fallop, and the muscle, lie in ambush at the bottom, with their shells open; and, whatever little fish inadvertently comes into contact, they instantly close their shells upon it, and, at their leisure, devour it in the concealed mansions of a prison, from which there is no possibility of escape.

In what manner digestion is carried on, to such an amazing extent and rapidity, in the stomachs of fishes, no inquiries of naturalists have yet been able to ascertain. If we were to judge from their substance or heat, we would be led to conclude, that the digestive powers of these animals are feeble and imperfect; whereas, they appear so far to exceed every thing that can be effected, either by trituration, the operation of heat, or of a dissolving fluid, that a celebrated physician, after various experiments, has been of opinion, that none of these causes is equal to the effect †; and that the power of digestion, in the cold maw of fishes, is so great, as to overturn those systems, that have attempted to account for it on these principles.

The powers of assimilation in fishes, seem to increase with the quantity of food with which they are supplied. A pike sparingly fed, can be habituated to subsist on very little nourishment; if fully supplied, it acquires the power of devouring an hundred roaches in three days. The digesting power of fishes, is as extraordinary, as their

* Goldsmith, Nat. Hist. vol. vi.

† Dr. Hunter.

their appetite is voracious. The cod and sturgeon will not only swallow, but dissolve crabs, muscles, lobsters, and every kind of shell fish, whose coverings are much harder than the coats of their stomachs. On dissection, the maw is found to be a soft bag filled with shells; the calcareous earth of which, undoubtedly, supplies the animal with nourishment. From this fact it would appear, that fishes are supplied with a powerful solvent, hitherto undescribed, which enables them to convert the substances they swallow into a fluid, fitted for their peculiar support.

Some exceptions to the extraordinary voracity of fishes, are produced by naturalists, which, if fully examined, will, perhaps, appear more apparent, than real. Some are said to subsist on pure water alone; an assertion, which is supposed to be proved by numberless instances of their subsisting, for several months, in ponds constructed of hewn stone, where they had been supplied with no food *. It is alleged too, that those, which are carried from a distance to the markets of *London* and *Paris* in perforated vessels, must subsist upon water alone.

The element of water, however, is seldom found pure and unmixed. The very epithets of salt, bitter and sweet, imply a composition and mixture, perceptible even to the taste. The particles of the earth upon which it runs, necessarily enter into it, and vitiate its purity. These substances, together with myriads of animalcules with which it teems, may supply, for a while, a scanty subsistence, and support the life of the most voracious animals.

In

* Rondelet. apud Will.

In the mean time, it will readily be allowed, that fishes, though for ever hungry and prowling, can endure the want of food for a long time. In them, habits seem to be formed by the circumstances in which they are placed. Want produces abstinence; from abundance they learn voracity. A pike, one of the most gluttonous of fishes, will live, and even thrive, in a pond where there is none but itself; and the gold and silver fishes, which we confine in glass vases, subsist, frequently for years, without any visible support but water. *Rondeletius* mentions one that was kept at his house, in this manner, for three years, which grew to such a size, that the vase could scarcely contain it, nor could it be brought out at the same passage by which it was introduced into the vessel *. It would appear, therefore, that, in certain situations, fishes are as remarkable for abstinence, as, in others, they are distinguished for voracity; and that Nature, in compassion to the want which they must often suffer, has indulged them with a power of accommodating their appetite to scarcity of food, as well as to abundance.

SECTION IV.

Of the Generation, Fecundity, &c. of Fishes.

THE grand division of fishes into the cetaceous, cartilaginous, and spinous, was formed by *Aristotle*, according to

* Hoc modo suavissima mea conjux, tres annos, piscem domi aluit; sicque educatus, in eam corporis molem accrevit, ut tandem nec vas cum sapere, nec qua ingressus fuerat, eadem exire posset. *Rondelet.*

to the three different modes of their generation. Among those of the first order, fecundation is accomplished within the body of the female, by means of a *penis intrans*, as in terrestrial animals. They are all viviparous; that is, the female, after having been fecundified by the male, and after a certain period of gestation, produces a living and perfect animal.

The cartilaginous are also all, except some species of the sturgeon, viviparous; and among this order too, fecundation seems to be performed within the body of the female, who conceives two or more large eggs, distinctly containing red and white, like those of birds. In these eggs the fetus is formed; and, by the white of them, it is fed, while it is hatched within the body of the mother, without being excluded in the egg state, as is the case in birds. In this state, the eggs have been found in the belly of a dogfish, with the young completely formed, and of a very considerable size *. The number of these eggs lodged at one time in the uterus, is various, according to the species to which the animal belongs. One naturalist † observed in the belly of ‡ a dogfish, six that were arrived at their full size, besides many others, in which the fetus was scarcely formed; another saw, in the *cornua uteri* of a torpedo, six eggs on one side, and eight upon the other.

The mode of generation that obtains among the viviparous or spinous fishes, is, from their situation and manner of life, involved in great obscurity. It is generally supposed, that their eggs are not fecundified, till after their exclusion from the matrix of the female. They seem, indeed, amidst their evolutions in the deep, to co-

* Raius apud Willough. Lib. I. cap. ix.

† Rondeletius.

‡ Francisc. Redi. Galei Spinacis.

pulate; but, as the male is furnished with no external organs of generation, his junction with the female is only to emit his impregnating milt upon the eggs, as they fall from her body. For this purpose, it is said, he pursues them along the stream, carefully impregnating them, one after another.

These facts, however, are controverted by *Linnaeus*, who maintains, that no fecundation can take place, except within the body of the female *, although the generation of frogs and lizards has always been regarded as an example of the contrary. In support of his hypothesis, he asserts that he observed, at spawning season, every male pike surrounded by several females; and that, as soon as the milt was ejected by him, it was immediately swallowed by the females; a procedure which he had occasion to notice in several other kinds of fish.

The experiments that have lately been made at *Berlin* by a skilful naturalist †, seem totally to overthrow this doctrine of *Linnaeus*. It has been found, that of both salmon and trout, the roes, artificially extracted from the body of the female, were capable of being fecundified by an admixture with the milt of the male. Hence it is probable, that, though both the male and the female concur in the great work of impregnation, yet the act is performed without the body of the latter; and that the spawner ejects her eggs, while the milter sprinkles them with sperm.

The science of ichthyology is still in its infancy. Supported by few accurate observations, and still fewer experiments, it has hitherto been regarded as a field for

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theory,

* *Fide* Systema Naturæ ad locum,
M. Jacobi.

theory, speculation, and conjecture. Hence we are no sooner free of one difficulty, than we are met by another equally perplexing and insurmountable. It has long been a question, among philosophers, whether fishes are produced by spontaneous generation*. That they are, an ancient naturalist pretends to have proved by his own experiments and observations†. There is, says he, in the vicinity of *Pisa*, and surrounded, on every side, by hills, a place, into which the waters of no fountain, stream, or lake, ever flowed; a place, which no moisture, except the rain from the clouds, ever watered. A few days before my arrival at this spot, a copious shower of rain had overflowed it with water, and nature herself had supplied it with fishes, among which vast numbers of carp were observed. The same thing, he adds, is seen in many pools in *France*, into which no stock, or original, of the many various fishes they contain, was ever placed.

Another philosopher has adopted the same opinion concerning the spontaneous production of fish; because, in ponds newly dug out, fishes have been observed during the first year; and, in succeeding ones, many other different kinds, although none had been originally transported thither‡. It is a phenomenon in Nature, for which it is indeed difficult to account, but notwithstanding an incontrovertible fact, that in stagnating pools occasioned by the rain in *Bombay*, which have no communication with any river, or the sea, fishes are generated, of which many persons have eaten, and which,

upon

* Willoughby, lib. I. cap. ix.

† Rondeletius de Piscib. lib. I. cap. iv.

‡ Albertus magnus apud Gesnerum.

upon the drying of these ponds, die, and are corrupted *. But, however difficult these appearances may be to explain, or in whatever manner the fishes were introduced into these ponds, we must conclude, that they were originally produced from the eggs of animals of their own kind ; because the idea of spontaneous generation is repugnant to every maxim of sound philosophy †.

Fishes, in general, are male and female ; the former possessing the *milt*, and the latter the *roe*. Some individuals of the cod and sturgeon, are said, indeed, to contain both. The spawn of the greater number of fishes is deposited in the sand or gravel ; and, in that state, it is probable, that the roe and milt are mixed together. Summer is the most common time for the spawning of fishes ; because, at that season, the water is tepidified by the beams of the sun, and therefore better fitted for quickening the eggs into life. It is probably for this reason, that the herrings frequent the shores of Britain, at the spawning season ; there not being, in the unfathomable depths of the ocean, a sufficient quantity of heat to hatch their eggs. When they have deposited their burdens, they return to their former stations, and leave their infant progeny to shift for themselves.

The spawn of different fishes continues in the state of eggs, sometimes for a longer, and sometimes a shorter period. In general, however, this period is proportioned to the size of the animal. In the salmon kind, the young animal continues in the form of an egg, from the month of December till April ; the young carp con-

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tinues

* *Vide* Lind. on hot climates, Part II p 12 .

† Linnaeus, omne animal ex ovo.

tinues not, in that state, for above three weeks ; and the gold fish from *China*, is produced in a still shorter period *.

When excluded from the egg, the young fishes all, at first, escape by their minuteness and agility. They perform all their motions with much greater celerity and ease, than grown and bulky fishes ; and can make their way into shallow water, where they cannot easily be pursued. But, with all these advantages, not one, perhaps, of a thousand, survives the dangers of its youth. There is no instance, among the spinous fishes, of any thing resembling parental affection : They all abandon their eggs to be hatched by the heat of the season † ; and, if they ever return to the spot where their young have begun the career of life, the male and female that gave them birth, forgetting all parental relation, become enemies as formidable as the most rapacious plunderers of the deep.

Though the fishes fall in millions by the rapacity of one another, yet they have other enemies than the animals of their own kind. Many of the quadrupeds frequent the shores, rivers, and lakes, where fish is almost their only food ; and we have already had occasion to remark, that a great proportion of the fowls reside constantly on the sea, where they either feed upon spawn, or become the merciless invaders of the small fishes. Thousands too of the human race, wander, in a savage state, around the lakes and rivers, whence they derive a considerable portion of their sustenance. And, among those

* Goldsmith's Nat. Hist. Vol. VI.

† The *callis bavia* is the only exception to this observation ; it is said to sit upon its eggs at the bottom of the water.

those nations, whom arts and agriculture have rendered less dependent on this precarious support, superstition has come in the place of want, and given a new edge to their avidity for this species of food. From the invasions, therefore, of terrestrial animals, and from their own mutual rapacity, the annual consumption of fishes is constant and immense ; but the munificent Author of Nature has made a kind provision for his creatures, by the amazing fertility which he has conferred on this class of beings.

The fecundity of fish in general far surpasses that of any other animals ; in some, it exceeds belief, for there are individuals among this class of the animal kingdom capable of producing, in one year, a greater number of their species than all the inhabitants of Great Britain. Nine millions of ova have been found in the spawn of a single cod * ; one million, three hundred, and fifty-seven thousand, four hundred, have been taken from the belly of a flounder : The mackerel, carp, tench, and a variety of other species, are said to possess a degree of fertility but little inferior †.

Such an astonishing progeny, were it allowed to arrive at maturity, and to add the whole of its number to the rest of the family, would soon overstock Nature, and even the ocean itself would not be able to contain, much less to provide for the half of its inhabitants. Of the ova spawned by these different fish, however, probably not one in an hundred ever becomes a full-grown animal : They are devoured by the lesser fry that frequent the shores, by aquatic birds near the margin, and by the

* Dr. Lewenloch.

† *Vide* Farmer's calculations, Philosophical Transactions, 1767.

the large fish in the deep water. Such as still survive, are sufficient for supplying the ocean with inhabitants; and of these, notwithstanding their own rapacity, and that of the aquatic fowls and terrestrial animals, enough is left to relieve the wants of a great portion of the human race. Thus, two important purposes are answered in the economy of Nature by the extraordinary fecundity of fishes: it preserves the species amidst numberless enemies, and serves to furnish the rest with a sustenance adapted to their nature*.

Among terrestrial animals, there are various degrees of fertility, according to their chance of destruction, from the want of courage, bulk, or strength: The largest are always least productive, and the smaller are more prolific, in proportion as the dangers increase, to which they are exposed†. The same observation may be extended to the inhabitants of the ocean: Among these, as the cetaceous fish resemble quadrupeds in their habits and conformation, so they are distinguished by a similar degree of sterility. All the whales, and even the cartilaginous fishes, are not, perhaps, superior to terrestrial animals in their powers of production. Among the hungry and heedless inhabitants of the sea, they are distinguished by finer organs and higher sensations. Their size and courage place them, in a great measure, beyond the reach of danger; they nurse their young with tenderness and assiduity, and they protect them from injury with an obstinate intrepidity little inferior to that of the lion or the eagle. Hence the number of their young is few, proportioned to the dangers to which they are exposed: A-
midst

* Goldsmith's Nat. Hist. vol. VI.

† Buffon's Hist. generale et particulaire, tome 16.

midst that security which they enjoy, and the ease with which they can repel the hostility of the inimical tribes, they run but little hazard of being destroyed by their rapacity.

SECTION V.

Of the Growth, Longevity, and Dietical Uses of Fish.

As the dangers to which the progeny of all the spinous fishes, while in the form of ova, and in their nascent state, are innumerable, and surrounding them on every side, Nature has happily ordered, that they should remain but a short time in that defenceless condition. The period at which the different species arrive at their appointed size, is not exactly ascertained; but the generality of naturalists agree in reckoning it extremely short *. Aristotle, and Pliny who copied him, seem both to have committed a mistake, when they assigned only two years for the life of the tunny †, a fish which approaches to the size of a whale. This species had various different names assigned it, till it arrived at its fifth year, when it received the appellation of a whale; a circumstance from which we must conclude, that the ancients in general entertained a very different idea of its longevity ‡. Of a
similar

* Rondeletius, de piscibus.

† Vita Thynnus longissima biennio. Plinii Hist. Anim.

‡ During the first year, they were called Scordyla; the second, Palami; the third, Thynnus; the fourth, Orcyni; and the fifth, Cete.

similar error, many of the moderns are guilty in asserting, that the common salmon arrives at its full growth in a year. Our most experienced fishers distinguish them also by different names, till they arrive at their sixth year, when they are supposed to have reached their full size: Those of the first year they call smelts; of the second, sprods; of the third, morts; of the fourth, fork-tails; of the fifth, half-fish; and of the sixth, salmons*. It is probable, however, notwithstanding the immense size at which many of them arrive, that fishes, in general, are of a quick growth, and that the period of their adolescence is small, in proportion to that of their lives. There is another peculiarity attending the growth of fish; and that is, the cetaceous kinds, which are by far the largest, inhabit chiefly the colder regions of the ocean, adjoining the poles. The reverse of this is the case with terrestrial animals, who always diminish in size as they recede from the heat; and by far the largest of them, the elephant, the camel, and rhinoceros, are only found in the warm or intratropical latitudes. It is probable, indeed, that the whales might prefer the more temperate regions of the ocean, and might even acquire a large size there; were they not compelled to avoid them by the frequent disturbance given by ships, and to seek that tranquillity, of which they are fond, in the inhospitable climes of the north†.

Hitherto, we have been examining fishes with regard to their external conformation, and have found them inferior to terrestrial animals in their organization, and in the number of their enjoyments. We are now to contemplate

* *Vide* Willoughby, lib. i. cap. 10.

† *Idem* *ibidem*.

plate them in a more favourable point of view, and that is, in the extraordinary period of time during which they possess the humble existence which Nature has assigned them. Their longevity is far superior to that of other animals *. We have already seen what ample provision is made for supplying them with food, by multiplying the inhabitants of the sea: They are, therefore, in little danger of perishing from want; and there is reason to believe, that they are, in a great measure, exempted from diseases.

Most of the disorders incident to mankind arise from the changes and alterations incident to the atmosphere; but fishes reside in an element but little subject to change; theirs is an uniform existence; their movements are without effort, and their life without labour. Their bones also, which are united by cartilages, admit of indefinite extension; and the different sizes of animals of the same kind among fishes is very various. They still keep growing; their bodies, instead of suffering the rigidity of age, which is the cause of natural decay in land animals, still continue increasing with fresh supplies; and as the body grows, the conduits of life furnish their stores in greater abundance. How long a fish, that seems to have scarce any bounds put to its growth, continues to live, is not ascertained †.

Some species of the German carp have been known to live an hundred years †; those species, however, with which we are best acquainted, seem not to enjoy so great a degree of longevity. The salmon, we have remarked, takes only six years to reach its full size; if we

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* Gesner de piscibus.

† Vide Bacon's works.

allow four or five times that space for the period of its life, it will not exceed thirty years.

Different methods have been devised for ascertaining the age of fishes, some of which will, perhaps, pretty accurately determine this matter. The ingenious Mr. *Hiddoſtroam*, a Swede, has attempted to compute their ages by the number of concentric circles observed in a transverse section of the vertebræ of the back; and it has been found, that each circle, like that in the section of a tree, corresponds to a year of the animal's life. In confirmation of this fact, experiments have been made on different individuals of various sizes, but of the same age, whose concentric circles have always been of an equal number; whereas a young fish differs from an older one of the same species, by having a smaller number of these circles. By this method of computation, several fish were found from fifteen to twenty years, but none gave indications of a greater age.

Another method of computing the age of fishes, practised by M. de *Buffon*, is by numbering the concentric circles upon their scales*; but as this requires a more minute examination, it is, of consequence, liable to greater uncertainty. On examining the scale of a fish through a microscope, it exhibits a number of circles, one within another, resembling those in the vertebræ of the back, and, like them, every circle represents a year of the fish's life. A scale of a carp, thus examined, announced the animal to be no less than an hundred years; a longevity less incredible, because confirmed by the testimony of several different authors†, some of whom have asserted, that this fish lives twice that period.

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* *Vide* Hist. gener. et part.

† Gessner and Albertus.

The dietical uses of fishes are to us the most important article of their history, a part that is happily free from that uncertainty and darkness in which many other circumstances relating to their manners and economy are still involved. All fish whatever, and particularly those without the tropics, are capable of being converted into wholesome food. Every *European* fish, while in season, is nutritive; the various methods of preparing and dressing them are detailed by the Authors to whom that province belongs. Such disquisitions constitute the history of an art, but they are not the objects of science.

Fishes, in general, when out of season, are unwholesome, and even pernicious; and this is more especially the case with the oily kinds; such as the herring, the mackerel, the eel and the salmon. So little is this fact attended to, that the eating of the latter of these fishes, at an improper season, has been the immediate cause of an epidemic fever. Some of the fishes that frequent the shores of the *West-Indian* islands, are said to be poisonous: that they are naturally so, however, may be justly questioned; though there can be no doubt of their becoming pernicious in certain circumstances. If they feed upon copper-banks, their food may contain so great a quantity of the poison combined with that metal, as may render their flesh noxious; and the same consequence will ensue if they devour the seeds of some poisonous plants that grow in these parts of the globe.

The improvement of the arts tends greatly to extend the dominion of man over the inferior animals; the art of navigation, in particular, may be said to have completed his conquest of the ocean, and brought a vast ac-

cession both to the fund of his subsistence and enjoyments, by the capture of so many animals whom Nature seemed to have placed beyond the reach of his power. A fleet of fishing vessels, manned by a few thousand *European* sailors, is capable of taking a greater number of fish in a season, than perhaps could be done by all the savages on the continent of *America*. But the superstitious regulations of the Romish Church has tended more than any other circumstance, to enhance the value, and increase the quantity of this species of food. To supply the imaginary abstinence of the devout or superstitious, large demands are annually made upon the sea; and to make up for the deficiency of this precarious supply, ponds have been dug, and fish, like land animals, rendered domestic.

In the construction of these ponds, it may be proper to observe, that, if intended for breeding, they ought to be of various depths, from six feet to six inches; for few fish will spawn in water of any considerable depth. Such pieces of water ought also to be partly filled with aquatic plants; because these afford shelter and nourishment to different kinds of insects, that contribute to feed the fishes: For a similar reason, fish ponds ought to be surrounded with trees, that the insects frequenting them may afford an additional supply for their sustenance. In arranging the fishes in these receptacles, attention ought to be paid to the different species that are introduced into the same pond. Carp and tench agree well together; but they frequently do not thrive when mixed with any other species. The perch is almost the only fish that can be safely entrusted in a sheet of water frequented by the pike.

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In populous countries, like *China* or *Holland*, where every article of food is in request, and every spot of ground is turned to account, great attention is paid to the structure and management of fish ponds: There experience has taught men to ascertain the quantity of every kind of fish, which any given space of water can support. Ninety brace of carp, and forty of tench, may be supported in an acre of water; a greater number would languish and die. In transporting fish from rivers into ponds, it has been found that the young thrive much better after the operation, than the old; for at that period of life, they possess a power of more easily accommodating themselves to any change in their situation.

In some parts of *Germany*, where the domestication of fish is practiced, the ponds are constructed in a suite, one adjoining another; and, by means of a communication between them, they can empty the water of one pond, together with the fish, into another. After this is accomplished, the empty one is frequently plowed, and sown with barley: When the grain is in the ear, the water, with its inhabitants, are again admitted to feed upon the grain, and are thus more expeditiously fattened than by any other management. In all fish ponds, the milsters are the preferable fish, for they become much fatter than the spawners.

Fish of different species, as well as terrestrial animals, are found capable of producing an offspring; but their cross breeding is a very obscure article of their history. Few species have hitherto been domesticated, and on these, but a very small number of well-attested experiments are known. A cross breed is said to be obtained between the carp and the bream, and between the carp and tench: That

That between the carp and tench was produced by mixing the milt of the former with the spawn of the latter ; the offspring, which was examined by Mr. *Pennant*, bore a greater resemblance to the male than the female parent*.

It is remarkable, that so few species of this class of the animal kingdom have been translated from their primitive haunts, and made subservient to man by domestication. Only three kinds have been transported from foreign parts into *Britain* ; the carp, the tench, and the goldfish. Double that number are domesticated with success upon the continent ; but even this, in all probability, is but few to what might easily be rendered subservient to the same purpose, by the industry of man. There can at least be entertained no doubt that those domesticated upon the continent would thrive equally in *Britain*.

The *caprinus coruscus* is found indigenous in many of the rivers in *England*, where it is called the rudd. It is reckoned a superior fish to the carp in many respects, yet it has never been domesticated in its native country, though reared with great advantage in the fish ponds of *Sweden*. The *cobetus fossilis* is a fish unknown in this country ; but is domesticated, with profit, in the ponds at *Stockholm*, and might, with equal propriety, be translated into those of *Scotland*. In the same manner, the *cobetus barbatula*, which was introduced into *Sweden* by *Frederick I.* might be made an inhabitant of our artificial ponds. The *salmo tymalis* of *Linnaeus*, known in *England* by the name of graylin, is one of the best fishes both for sport and the table, and might easily be transported here from the streams of *Derbyshire*, its native residence.

* *Fide* Brit. Zool. Vol. III. class iv. p. 356.

residence. Both eels and charr might be rendered useful pond-fish; as neither are too delicate for transportation; and, from experiments already made, the certainty of their thriving is fully established.

If the translation of fish has not been often attempted, it certainly is not because they are incapable of sustaining various degrees of heat, and of living in different climates. The necessity of procuring a supply of food; of seeking a safe retreat for propagating their species, or a temperature of that element in which they live, suited to their constitutions, compels the fishes, as remarkably as terrestrial animals, to make extensive migrations from one part of the sea to another. With regard, however, to this curious subject, we have but few facts upon which we can depend.

The fish, like land animals, are either solitary or gregarious: Of the former kind, trout, salmon, pike, &c. the migrations are probably in quest of a proper place to deposit their spawn. The salmon, for this purpose, leave the sea, and mount the rivers in the beginning of winter, where they dig in the gravel, deposit their burden, and again return. The trout likewise ascends near the source of the rivulets at the season, when they enter the smaller branches that run into the main stream, for the purpose of spawning. It is then they are often seen in small rivulets upon the high grounds, in water so shallow as scarcely to cover their bodies.

Of the gregarious fishes that frequent fresh water, we know but little concerning their migrations. It is probable, that the perch and the minnow are stationary, and that they retire only to the margin of the river to deposit their spawn. The fishes, most remarkably gregarious,
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are inhabitants of the sea ; such as the cod, ling, herring, pilchard, and sparling. The migrations of the herring are well known. In the months of June and July, it issues in vast shoals from the unexplored regions of the northern ocean ; surrounds the *British* isles, and enters the bays and arms of the sea. These fishes are known to take up their residence in some particular loch or creek for eight or ten years, and then to resort to another for a similar period. The tythe, the calfish, the cod, and whiting, have all their seasons of migration. The last, in particular, are probably forced upon those immense journeys from the coasts of *America* to those of *Spain* and *Africa*, to avoid the pursuit of the cod, and other rapacious invaders.

From these observations, it would appear, that fish of the same species are capable of living in very different quarters of the globe, and of enduring various degrees of heat and cold ; a circumstance which opens a vast field for the enterprise and ingenuity of man in transporting them, and rendering them subservient to the purposes of domestication. It is impossible to determine to what length this operation may be carried, or to ascertain how great an accession might thus be made to the sustenance of the human race.

CHAPTER II.

SECTION I.

Generic Characters of the Cetaceous Fishes.

THE cetaceous fishes constitute the first order, according to the Aristotelian division; and have obtained from him that name, on account of their enormous size, and their producing a perfect animal from *semen*, and not from *ova* *. These animals, from the more perfect conformation of their organs, as well as their superior bulk, are fully entitled to the first rank among the inhabitants of the ocean. Among the terrestrial animals, we have seen some endowed with higher powers, and more various instincts; and thereby challenging a superior rank among the kindred tribes. The same distinction obtains among the aquatic orders, where the whale, possessing the organization and many of the habits of quadrupeds, claims the first station among his companions of the deep †.

This order contains the whales of all the various kinds, who want teeth; the cachalot, with teeth in the lower
 VOL. III. F jaw;

* Willoughby, lib. ii. p. 26.

† Goldsmith's Nat. Hist. vol. VI.

jaw ; the dolphin, with teeth in both jaws ; the porpesse ; and the grampus. Such are the marks by which the different tribes of this division are distinguished from each other ; but the most striking and obvious character by which they are at once discriminated from all other animals, is their immense size. The testimony of all ancient writers concurs in ascribing to them a bulk far surpassing the largest animal known upon the globe. In those books which *Juba* wrote to the son of *Augustus Cæsar* concerning *Arabia*, whales of six hundred feet long, and three broad, are said to have entered a river of that country *. *Pliny* himself vouches the extraordinary size of two hundred and forty feet in length, by eighteen in breadth ; and *Nearchus* declares, that he saw on one of the islands opposite to the mouth of the *Euphrates*, a whale of an hundred and fifty cubits, cast out upon the shore. *Arrian* †, *Strabo* ‡, and *Diodorus*, mention nations of savages bordering on the *Indian Ocean*, which built their houses of the bones of whales cast out by the sea, using their jaws for door cases ; and we find from *Frobisher*, that the same method of architecture was formerly practised by the inhabitants of *Greenland* §.

Many later writers give a similar account of the magnitude of whales. Even within the arctic circle, they were formerly of a prodigious size, when their capture was less frequent, and the fish were allowed to grow. We know, by the accounts of travellers, that within the torrid zone, where they are unmolested, they are still seen one hundred and sixty feet in length ||. Those at present taken in the *Greenland* seas, seldom exceed eighty or ninety

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* *Pliny*, lib. xxxii. cap. i. † *Liber viii.* ‡ *Liber xv.*

§ *Vide Second voyage*, p. 18. || *Adamson's voyages*, p. 174.

ty feet in length, and about twenty in breadth: Even these, however, must appear enormous to the spectator, and, when first beheld rising from the deep, must have struck him with astonishment and terror. Those who frequent the northern ocean, to whom the frequency of the sight has rendered it less tremendous, must enjoy a magnificent spectacle in beholding such an enormous animated mass tumbling amidst the waves, and darting through the water with incredible velocity! Such wonders does Nature present in an element where her operations are but partially known; perhaps she has still greater wonders concealed in the deep, which we have had no opportunities of exploring. The whales are obliged to shew themselves upon the surface, in order to take breath: but who knows the size of those animals that are fitted to remain for ever under water; and that have been increasing in magnitude for centuries*.

Though we now see no whales two hundred, and two hundred and fifty feet, which we have good reason to believe was the case two centuries ago, still the size of this order of beings is sufficient to distinguish them from all the rest of the animal kingdom. It is probable, indeed, from skeletons that have been found at different times, that there once existed terrestrial animals of much greater bulk than are to be found at present. Creatures of such an immense size must have required a proportionable extent of ground for subsistence; and by being rivals with the human race for large territory, they must have been destroyed in the contest. A similar cause has

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diminished

* The sea-serpent, or kraken, is said to be several miles in circumference, and to appear like a small island. To believe all such relations would be credulity; but to deny their possibility, would be presumption. Goldsmith's Nat. Hist. vol. VI.

diminished both the number and the size of the cetaceous tribes: Man had no sooner completed his sovereignty over the ocean by the invention of the compass, than these animals were so much thinned by continual capture or destruction, that they have never had time to arrive at that enormous bulk which the peaceable possession of the sea, in former ages, conferred *.

The external conformation of the fishes of this genus, no less than their size, serves to characterise them among the other inhabitants of the deep. They are covered with a dark-coloured cinereous skin: they are moved, commonly against the wind, and with vast rapidity, by means of a horizontal tail, aided by three fins; two pectoral, and one back fin; but in some species, the last is wanting. The head is commonly extremely large, in proportion to the size of the body, being in some equal to a third of the size of the fish. The animal is directed to its prey by two small eyes, furnished with eyelids, and not superior in size to those of an ox. As the cetaceous tribes all breathe by means of lungs, they have no branchiæ nor external apparatus for that purpose †. In the middle of the head, there is one, sometimes two orifices, through which they spout water to a vast height, and with a great noise. With these orifices raised above the surface, the whales sleep and breathe, gently moving their fins, to keep them poised upon the summit of the water ‡. When immersed below the surface, or while devouring their food, water unavoidably rushes into the throat and lungs, and is, in this manner, ejected every time they rise for a supply of air. If the animal be wounded, it spouts the air and water with a violence sufficient

* *Vide* British Zoology, class iv. gen. I.

† *Aristot. Hist. Animal.*

‡ *Willough. lib. ii. cap. I.*

sufficient to overfet a fhip ; and the noise it occasions, is heard like the difcharge of cannon, at the diftance of fome miles.

Animals of fuch enormous ftrength and magnitude, we might imagine, would fpread terror and devaftation all around them, and make an indiscriminate flaughter of the inferior tribes. No creature, however, is lefs voracious than the common whale : Almost no animal fubftance is ever found in its ftomach ; it feeds, as fome allege, upon different infects that float on the furface ; according to others, upon the *medufa* or fea-blubber *. Its food, we are certain, muft be extremely minute, for the capacity of its throat does not exceed four inches, a fize beyond all proportion, fmaller than that of other fifh.

The fmall quantity of food that fuffices the whale, may juftly furprife us, when we confider their fize, and the numbers of thefe animals that often herd together. Had their voracity been proportioned to their bulk and numbers, the ocean itfelf would hardly have afforded a fufficient fupply. The infects upon which they feed, are black, and about the fize of a bean : They are of a round form, like fnails in their fhells, and are feen floating in clufters together upon the waves. Thefe, the whale fucks up in great numbers, and bruises them with the barbs or pipes with which its mouth is internally covered †. Nourifhed with this food, it becomes the fattest of all animals, whether terreftrial or aquatic.

To a flemder appetite, the whale adds peaceable and harmlefs manners : it purfues no other fifh, but leads an eafy and indolent life on the bofom of the waves, and is inoffenfive,

* *Vide* Lin. *Systema Nat.*

† Goldfmith's *Nat. Hift.*

inoffensive, proportioned to its ability to do mischief. Among land-animals, we have had occasion to observe, that sovereignty does not always follow strength or size * : The elephant and camel fly before the tyger and the lion ; while the eagle possesses a decided superiority over the vulture and the ostrich. The same law obtains among the inhabitants of the ocean ; where the whale, if he holds the sceptre, holds it by a precarious tenure, for it may easily be wrested from him by his subjects. There is a strong analogy between his manners and those of the elephant : Both are the strongest and largest animals in their respective elements ; neither offers injury ; and each is terrible when provoked to resentment.

But these peaceable and innoxious habits do not equally belong to the whole of the cetaceous order : The fin-fish differs from the great whale in this respect ; it subsists chiefly upon herring, and is often seen driving vast shoals of them before it. Those of the cachalot tribe are still more voracious, and commit greater depredations : They are furnished with teeth both in the upper and lower jaw ; their throat, though inferior in capacity to that of the cartilaginous fishes, is much larger than in the common whale ; and these powers of deglutition were probably conferred to gratify the cravings of an appetite proportionably more voracious. It is said, that the fishes of this genus are possessed of a courage, that often proves fatal even to the animals of their own order : they pursue and terrify the porpoises to such a degree, that they often drive them ashore †.

The common whale, whatever honours vulgar prejudices may have conferred upon it, has no pretensions to the

* *Vide* Buffon, Hist. gen. et part.

† *Vide* Lin. System. Naturæ.

the sovereignty of the ocean : On the contrary, as it is a peaceable and inoffensive animal, it has many enemies disposed to take advantage of its disposition, and inaptitude for combat *. There is a small animal of the testaceous kind, called the whale-louse, that sticks to its body, as we see shells stick to the foul bottom of a ship. This creature insinuates itself chiefly under the fins ; and, in defiance of all the efforts of the whale, it still keeps its hold, and lives upon the fat, which it is provided with instruments to extract. The fishermen, however, often witness the encounters of the whale with a much more terrible enemy. At the sight of the sword-fish, this largest of animals is seen agitated in an extraordinary manner, and leaping from the water as if with fear. Wherever it appears, the whale perceives it at a distance, and flies from it in the opposite direction. The whale has no instrument of defence except the tail : with that it endeavours to strike the enemy ; and a single blow taking place, would effectually destroy the adversary : But the sword-fish is as active as the other is strong, and easily avoids the stroke ; then bounding into the air, it falls upon its subjacent enemy, and endeavours, not to pierce with its pointed beak, but to cut with its edges. The sea all about is seen dyed with blood, proceeding from the wounds of the whale ; while the enormous animal vainly endeavours to reach its invader, and strikes with its tail against the surface of the water, making a report at each blow louder than the noise of a cannon †.

A still more fatal enemy of the whale, is an animal of its own order, called by the fishermen of *New England* the *killer*. Of ferocious habits, and furnished with strong sharp

* Goldsmith.

† Anderson's Dictionary of Commerce.

sharp teeth, these animals when they surround a whale seldom allow it to come off with life. They tear and mangle its flesh on all sides, till fatigued with fighting, and overcome with wounds, it falls a prey at last to their fury; and after it expires, the tongue is extracted, the only part which they devour.

By the constant hostilities of these various animals, the race of whales has probably been gradually diminishing in number for several ages *. From the largeness of their size they cannot easily be concealed from their destroyers; and as they are distinguished by sterility among the finny tribes, their destruction cannot soon be repaired: But of all the causes of the waste and diminution of this order of fishes, the interference of man has operated by far the most powerfully. His hostilities has been incomparably more fatal than those of all the rest of their enemies; and a greater number is probably destroyed in a season by the ingenuity of the fishermen, than is devoured by the rapacious animals in an age.

The inhospitable shores of *Spitzbergen* were found to be the great resort of the whales; and for more than three centuries, notwithstanding the coldness of the climate, and the terrors of the icy sea, a great number of *European* ships have annually frequented those dreary abodes, and at length thinned the number of their inhabitants.

The whale fishery was carried on, for the sake of the oil, long before the use of whale bone was discovered †. The substance which has obtained that name, adheres to the upper jaw; and is formed of thin parallel laminæ, some of the longest four yards in length. Of these there

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* *Vide* Brit. Zoology, Class. iv. Genus. 1.

† *Vide* Anderson's Dict. vol. i. p. 442.

are about seven hundred in all : about two thirds of that number are of a length fit for use, the rest being too short*. The oil is extracted from different parts of the body ; the tongue alone of some fish yielding from five to six barrels.

As early as the beginning of the fourteenth century, the *Biscayneers* were in possession of a very considerable trade to the coast of *Greenland* : They long enjoyed the profits of a lucrative traffic in train oil, and whale-bone, before the *English* attempted to obtain any share of that commerce. What probably first gave them an idea of the advantages to be reaped from it, was the accident of one of their ships bringing a cargo of whale-bone and train-oil from the bay of *St Laurence*, part of the burden of two large *Biscayan* ships that had been wrecked there about the year fifteen hundred and ninety-four †.

A few years after that period, the town of *Hull* had the honour of first attempting that profitable branch of trade. At present it seems to be on the decline, the number of fish being greatly reduced by their constant capture for such a vast length of time. It is now said that the fishers, from a defect of whales, apply themselves to seal fishery, from which animals they also extract an oil, and turn the skins to good account. This trade however will not probably be of any long continuance, for these shy and timid creatures will soon be induced to quit those shores by being perpetually harrassed. We are informed too, that the natives of *Greenland* already begin to suffer from the scarcity of seals in their seas. The flesh of these

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animals

* British Zoology, *ubi supra*.

† Hackluyt. Vol. iii. p. 194.

animals constitutes their principal subsistence ; and should they be at last extirpated, or desert the coast, that miserable people would be in danger of perishing through want*.

Before the year 1598, the whale seems never to have been taken on our coasts but when it was accidentally driven a-shore†. It was then deemed a royal fish, and the king and queen divided the spoil between them ; the king asserting his right to the head, and her majesty by prerogative entitled to the *tail*‡. A total revolution in the fashion of eatables, and the great quantity of these fish that are now imported, has rendered this prerogative of royalty of less importance, and even ludicrous : formerly however the whale as well as the porpoise, and dolphin, was probably a dish served at the royal board ; and from its magnitude it must have held a very respectable station there. Such dainties continued in vogue so late as the reign of *Henry VIII.* ; for, in a household book of that prince§, it is ordered, that if a porpoise should be too big for a horse load, allowance should be made to the purveyor. Even in the reign of Queen *Elizabeth*, we find directions for the dressing and serving up of the dolphin with porpoise sauce ; a composition of vinegar, crumbs of bread, and sugar||.

The flesh of the whale has always made a part of the food of some savage nations. The natives of *Greenland* as well as the barbarous tribes that inhabit the vicinity of the south pole, eat the flesh prepared in various ways, and drink the oil, which is with them a first rate delicacy. The finding of a dead whale is an adventure considered among.

* British Zoology, Class iv. Genus x.

† British Zoology, *idem ibidem*.

‡ Blackston, Comm. i. c. 4.

§ Archæologia, Vol. iii.

|| Gaij. Opuscula 116.

among the most fortunate circumstances of their wretched lives. They make their abode beside it; and seldom remove till they have left nothing but the bones*. In the days of *Willoughby*, the eating whale was growing into disuse in England †; and at present the *Dutch* sailors, as well as our own, will not taste it except in cases of urgent necessity: it is said, however, that the *French* seamen frequently dress and use it as their ordinary food at sea. The wretched inhabitants of the island of *Feroe*, who live one half of the year on salted gulls, are also, we are told, very fond of salted whales flesh: the fat of the head, after being well seasoned, they hang up in the chimney, and eat like bacon ‡.

The internal structure of the whale we have already remarked, resembles almost in every respect that of quadrupeds: Like them they possess lungs, a bilocular heart, a diaphragm and urinary bladder. The precise shape and situation of the viscera of these animals is indeed far from being so exactly ascertained as might have been expected, from the frequent opportunity there is afforded of examining them. In those parts where they are caught in greatest abundance, the sailors are not very curious in inquiring into the structure of the parts; and few anatomists care to undertake a task, where the operator, instead of separating with a lancet must cut his way with an ax ||. It is therefore not yet known whether the whale has not one of its bowels entirely adapted for the reception of air, in order to supply it with that fluid, when it is obliged to continue longer than usual below

G 2

the

* Goldsmith's Nat. Hist.

† *Duram habent carnem cetacea omnia; quamobrem his sicut conditis fore in cibis utimur.* Liber. ii. cap. I.

‡ Jacobson's Hist. of *Feroe*.

|| Goldsmith's Nat. Hist.

the surface of the water. We are certain, that there is no such receptacle for air among the viscera of terrestrial animals : The analogy however, is not here so strong as to justify us in denying the whale a particular provision of this nature, which the sailors assert that they have discovered, and which the necessities of the animal seem to require.

As the cetaceous fishes resemble terrestrial animals in their conformation, so they are also distinguished by similar appetites and manners : Among them the act of copulation is said to be performed *more humano*, and the female once in two years feels the access of desire. In the inferior tribes of fish we can discern hardly any thing like pairing between the males and females, and have no vestiges of conjugal fidelity. The mutual attachment of the whales, however, exceeds whatever we are told of the constancy of birds.

Whenever a pair of whales are attacked by the fishers, they mutually assist, it is asserted, in the defence of each other ; and when one is wounded the other still attends lending every aid in its power ; and no motives of fear or self preservation can urge it to desert its associate. An instance is recorded * of one, which, after maintaining an obstinate conflict in defence of its companion, that had been struck with a harpoon, and on seeing it expire under the wounds it had received, stretched itself upon the dying fish and yielded up its breath at the same instant.

The period of gestation among the cetaceous fishes is said to be nine or ten months ; the female commonly produces one, and never above two young. During the time of her pregnancy, and particularly at the birth of
her

* Anderson's Dict. Com.

her offspring, she is uncommonly fat. The embryo, it is said, when first perceptible, is about seventeen inches long; and the cub when excluded, is of a black colour, and ten feet in length*. The two breasts of the whale are hid within the belly; but when she suckles her young, she can produce them at pleasure, when they are protuberant about two feet before her body. The teats resemble those of a cow; while the colour of the breasts, in some is white, in others speckled; in all, they are filled with a large quantity of milk resembling that of land animals.

From what has been said concerning the procreation of whales, it appears, that these animals, in fecundity, are far inferior to the rest of the inhabitants of the deep. Nothing, however, can exceed their care and tenderness for their offspring when produced. The female whale carries her cub with her wherever she goes; and when pursued by the fishermen she keeps it supported between her fins. Even when wounded, she still clasps her young one; and when forced to plunge into the deep to avoid the strokes of her pursuers she carries it down along with her; but rises sooner than usual, to allow it time for respiration.

In defence of her young, the whale is said to display a fierceness and courage far beyond what could be expected from an animal, so gentle and inoffensive in its nature. *Waller*† describes the conduct of a whale and her cub, when surrounded in an arm of the sea, in a manner which strongly displays the maternal tenderness of these animals. Being deserted by the tide, they were inclosed
on

* *Vide* Goldsmith's Nat. Hist. Vol. 6.

† *Vide* his Poem of the Summer islands.

on every side ; and the people from the shore observing that they had no means left of escape, poured down upon them in boats, armed with such weapons as the urgent occasion offered. After several ineffectual attempts to escape, the mother at last, by her superior strength, forced herself over the shallow into deep water : But though in safety herself, she could not bear the danger that awaited her young one ; she therefore rushed in once more where the smaller animal was inclosed, and resolved, when she could not protect, at least to share its danger. Happily for the safety of these animals, the rapid inset of the tide soon enabled both to escape from their enemies, though not till they had received many wounds, and tinged the sea all around with their blood.

It is, however, but for a short period that the young whales stand in need of this parental assistance : Their growth is so remarkably rapid, that it may occasion some doubt concerning the accounts that are given of their extraordinary longevity. The cubs continue at the breast, of the mother only for a year, during which period they attain to a considerable size, and are called *short-heads* by the sailors. The mother, at the end of that period, is extremely lean and emaciated, while her cub is so large and fat, that it frequently yields above fifty barrels of blubber. The next year after they have left the breast, they are called *stunts* ; because they decrease in their fatness, and yield scarcely an half of the produce that is obtained from them when suckling. After two years the young whales are called *skull fish* ; and though for a while they continue of an inferior size, there is no mark by which their age can be ascertained.

Though the whales are gregarious animals, yet every individual

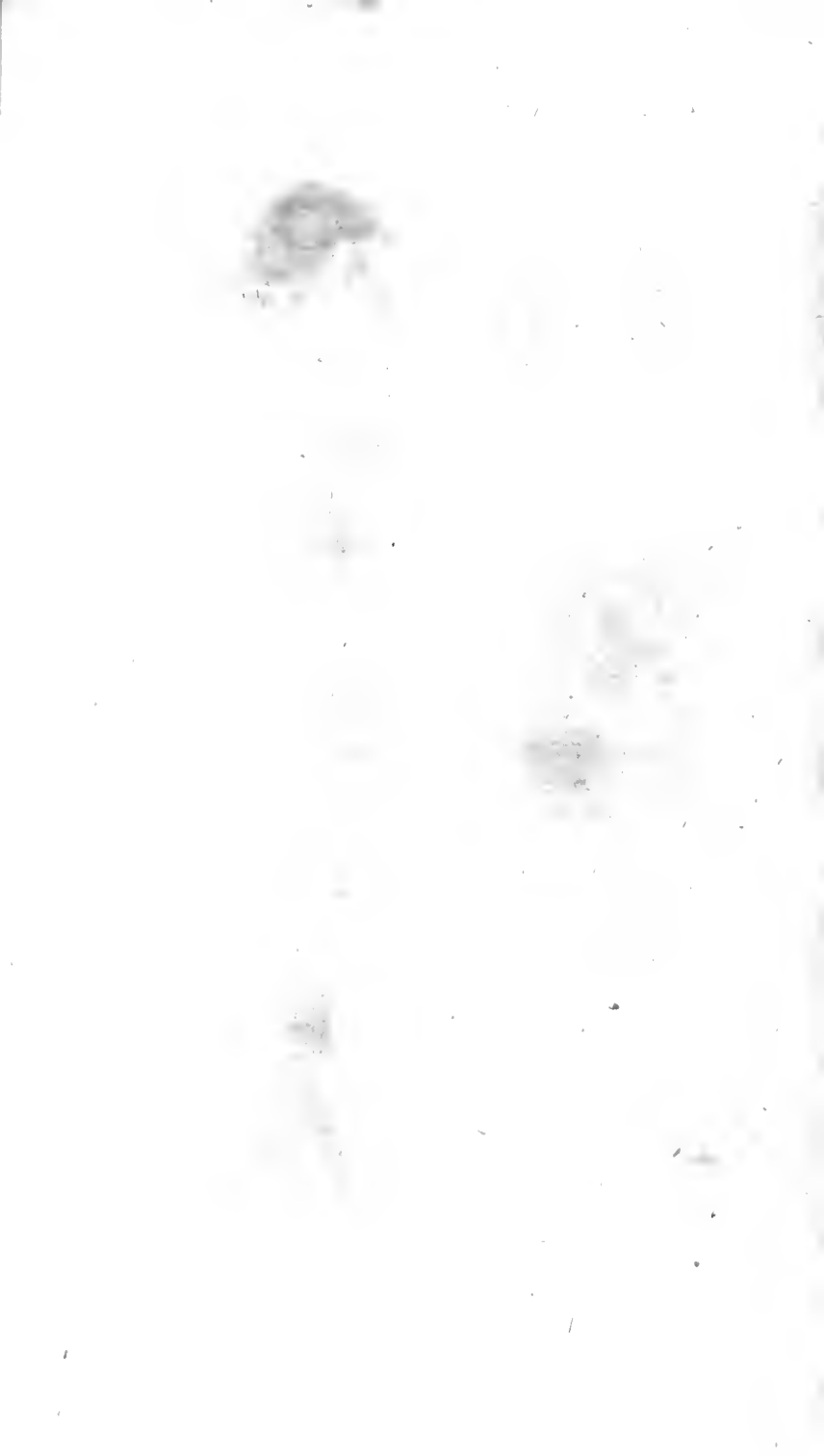
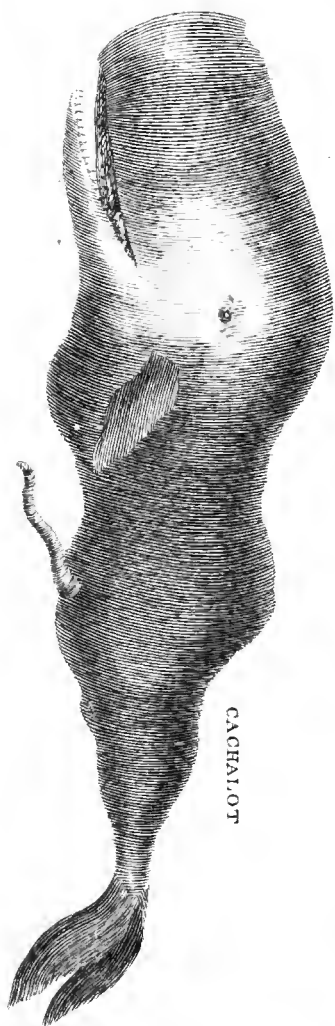
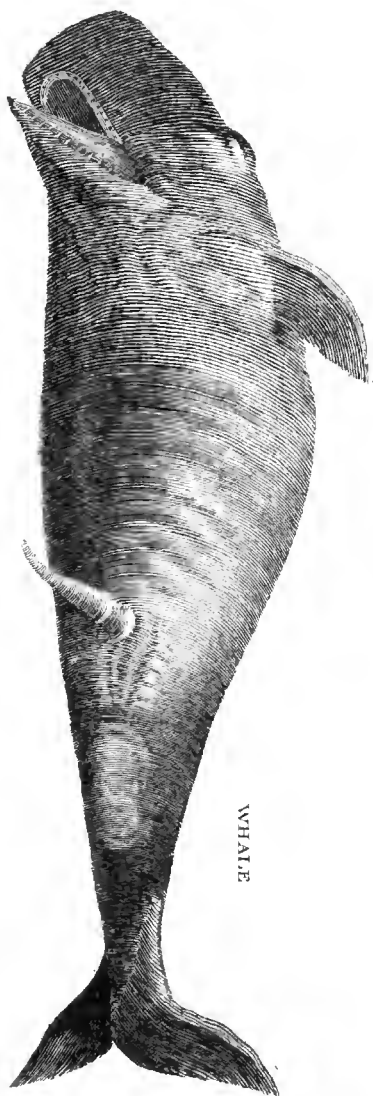


Plate I.



CACHALOT



WHALE

individual propagates only with those of its own kind; and without mixture of breed, they transmit an unpoluted race to posterity. When they are seen in shoals of different kinds together, or making their migrations in large companies from one ocean to another, their object probably is security and mutual defence. Hardly any instinct less powerful than that of self preservation, from the attacks of smaller but more powerful fishes, could induce them to an union by which the scarcity of food must be so greatly increased.

SECTION II.

The Common Whale.*

THIS is the largest animal known. In the north sea where it is most frequently taken, it measures from ninety to an hundred feet in length; and there is reason to believe that before the fishery had committed such vast depredations, there were many of this species seen of a far superior size †. In the warmer latitudes where they are less frequently taken, and consequently have time to gain their full size, they are still seen of the immense size of an hundred and sixty feet; a circumstance which seems to bestow credibility upon the relations of ancient writers.

Though

* Balena, Rondelet. Willough. Ichth. La Balaine ordinaire, Brisson,

† British Zool. Class iv. Gen. I.

Though the ancients were acquainted with this species of whale, yet it does not appear that they knew its uses, or practised the fishing of it. Aristotle has described it by the name of the bearded whale, from those hairs or strainers that surround the mouth to prevent the escape of its food, when the animal discharges the water from its mouth*. Pliny has given it the name of *Musculus*, probably for the same reason.

It has already been remarked, that the food of this species is the medusa or sea-blubber; and it is probably the necessity of procuring this food that confines the animal in its residence to the arctic circle. Few of them are ever seen so far south as the *British* shores, though the ancients mention a large kind that obtained its name, from frequenting our coasts †.

The head of the common whale is equal to one third of the size of its body: The fistulæ, or two orifices for spouting out the water are placed in the middle ‡. This species has no teeth: in their room are situated the black horny laminæ called whale bone, so long used in the ladies stays, in the construction of umbrellas, and for various other purposes. These laminæ give off a part of their substance which constitutes those bristles that surround the mouth, the supposed use of which has already been described. Closely confined by these bristles lies the tongue, the tenderest part of the animal, which was formerly salted up as a great delicacy §: It is now extracted only for the sake of the oil; of which it contains no less than six barrels.

About

* *Muræx*; Hist. anim. Lib. iii. cap. 12.

† *Quanto Delfinis Balena Britannica major*. Pliny, Sat. x.

‡ British Zoology.

§ Roudelet. apud Willough. p. 37.

About four yards distant from each other appear the eyes, externally not larger than those of an ox, but constituting a pretty large ball within. This picturesque visage is rendered tremendous by the large opening of the mouth, which, when the jaws are extended, is no less than eighteen feet wide*. On the back of this animal there is no fin: but the two lateral ones are exceedingly large; and with them, as we have seen, it supports its young. The tail is broad, semilunar and horizontal; it is of such vast strength, that by a stroke of it upon the surface, the water is so much agitated, as to upset a boat if it is near. The penis is included in a strong sheath, and is seven feet in length †.

The colour of whales varies very much; the back being in some red, and the belly generally white. Some are marbled with black and white, while others are entirely black, and some white. Their skin is smooth and slippery, and their colours in the water are extremely beautiful. In the belly of one described by *Rondeletius* there was found no kind of fish, only a sort of mucus, foam, water, and sea weed.

The Fin Fish ‡.

THIS species is distinguished from the common whale by the fin upon the back, placed low, and near the tail §. It is sometimes found in the *British*, but is more frequent in those tracts of the northern ocean, where the

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whale

* Idem ubi supra.

† British Zool.

‡ Le Gibbar. Brisson. Balæna Phyalus. Linnæus

§ British Zool.

whale fishery is carried on. It is, however, a booty which the fishermen seldom choose to pursue: The whale-bone adhering to its upper jaw is short and knotty, and therefore of very little value: The blubber also yielded by this species is very inconsiderable in quantity; and these circumstances, added to its extreme fierceness and agility, render the capture both difficult and dangerous; hence our seamen generally neglect it.

But meagre as this animal may seem to those whose object is the procuring of oil, it is held in great esteem by the miserable *Greenlanders*; for its flesh affords them a food which to men so poorly supplied is very agreeable.

This fish is generally of the same length with the common whale, but of a much more slender conformation. The lips are brown like a twisted rope: The spout-hole is as it were split in the top of its head, through which it blows water with much more violence, and to a greater height, than the common kind. The fishers are not fond of seeing it; for on its appearance the others retire from those seas*. It is impossible to determine whether this species be the same with the *Phyſalos* and *Phyſeter* of the ancient writers, so vague are the terms in which they speak of that fish†. If that particular name was assigned it from its faculty of spouting water, or blowing, the habit is not peculiar to any one species, but common to all the whale kind. It would appear from the name given it by *Linnaeus*, that he believed this to be the animal spoken of by these writers. *Rondeletius* and *Gesner* have been of the same opinion; but the description the first of these writers has given of this animal is in many respects

* British Zool.

† Vide Oppian Halent, L. 1. l. 368. Oelian Hist. anim. and Plin. lib. ix. c. 5.

respects erroneous; of this nature certainly is the assigning it sharp serrated teeth*. There are seven different kinds of the whale properly so called; five of these are enumerated among the *British* fishes. The common whale, the fin-fish above described, the pike headed whale, the round lipped, and the beaked. All these differ from each other in size and figure, as their names imply: Their manner of living is also somewhat different, the last described being more active and fierce than the rest. None of them have a large swallow, when compared with other kinds of fishes; none of them accordingly are very voracious; and if compared to the cachalot, that enormous tyrant of the deep, their manners will appear harmless and gentle.

The Narwhal, or Sea-Unicorn†.

THE narwhal is about sixty feet long, of a more slender make than the common *Greenland* whale; and its fat is in less abundance. It inhabits the seas of *Iceland* and *Greenland*, and is seen in the same northerly regions with the rest of the cetaceous tribes‡. Nature has, however, distinguished it from every other inhabitant of the deep, by that formidable weapon in the form of a tooth, which projects from its upper jaw. Amongst all that variety of armour which she has conferred upon her different tribes in the animal kingdom, she has contrived no instrument of destruction so dreadful as the horn of the narwhal.

H 2

I.

* Rondelet. apud Willough. cap. iv. page 41.

† Monoceros, Willough. page 42.

‡ Vide Bartholin. apud Willough. page 42.

It seems yet doubtful whether this extraordinary weapon of this fish grows naturally single or double in the animal. There is a skull at present in the Stadthouse of *Amsterdam*, which is armed with two of these teeth, which demonstrates, that in some subjects at least, this instrument is double*: But those which are taken with one tooth, give no sort of indication of having been deprived of the other by any accident: there appears no socket, nor any remains of a second tooth in the opposite jaw; all there is plain and even.

This extraordinary instrument generally springs from the upper jaw on the left side; into the socket of which it reaches a foot and an half. It is striated, and twisted in spires, as we sometimes see a bar of iron; its length is from seven to eight feet, and of the thickness of a man's arm: It is of a white colour, harder and heavier than ivory†. From the size of this weapon, most naturalists consider it as an horn, rather than a tooth; but it resembles in every respect the tusks of a boar, or an elephant; it rises like them, from a socket in the jaw; it is of the same strong substance, and possesses the same solidity. *Willoughby* regards it as the only real example of an unicorn afforded by nature; and after a minute examination of all the substances that are imposed upon the public for the horns of the unicorn, he pronounces them impositions on the credulity of mankind‡.

This naturalist had the greater merit in making a discovery of this nature, because in his time the capture of whales was not very frequent, and the means of detection

* Goldsmith's Nat. Hist. vol. 6.

† Idem ibidem.

‡ Vide Ichthyol. lib. ii. p. 43.

tion were proportionably few in number. The tooth of the narwhal about a century ago was universally ascribed to some land animal: it had often been dug up among fossil substances, and from that circumstance it was naturally bestowed upon a terrestrial owner. *Pliny* had long ago described an animal resembling a horse, with a single horn springing from the middle of its forehead *: Upon this animal, which a farther knowledge of nature has proved to be fictitious, the tooth of the narwhal was unanimously conferred; and the finding of so precious a remain, was considered as a fortunate incident, that afforded a strong testimony of the veracity of that historian.

But it was not the curiosity of mankind alone, nor the rareness of the object, and the singularity of its form, that brought the narwhal's tooth into such high repute in the different countries of *Europe*. A medicine was prepared from it, which was long given out by the quacks as an infallible specific against poison, and malignant fevers †. At length, however, these frauds were detected and exposed by one of the privy counsellors ‡ who had a concern in the whale fishery, and received by the return of his own vessels a number of those teeth, some of which were of the enormous length of three yards.

The error of supposing this armour of the narwhal a horn, has led some writers to suppose, that as among quadrupeds the female was often found without horns, so these instruments of defence were only to be found in the male. This, however, has often been contradicted by actual experience; both sexes are found armed in this manner;

* *Hist. Nat.*

† *T. Bartholin. Act. Med. An. 1673.*

‡ *Henry Muller.*

manner; and in all the varieties of the horn, whether wreathed or smooth, bended or straight, it is uniformly strong, sharp, and deeply fixed. There can be no doubt, but that an instrument of this nature is intended for the defence of the animal on which it is bestowed. It is thus that the narwhal uses it; whenever it is urged to employ this terrible instrument, it drives directly forward against its enemy, and pierces him through.

But notwithstanding this implement of war, and its amazing velocity and strength, the narwhal is one of the most harmless and peaceable inhabitants of the ocean. It wants teeth for chewing, and a throat for swallowing any bulky prey: Of consequence it commits hostility against no animal; but is constantly seen sporting inoffensively among the great monsters of the deep, never attempting to injure any of them. It is called by the *Greenlanders* the forerunner of the whale; for wherever it is seen, that fish seldom fails soon to appear. The manners of these two species nearly resemble each other; the food of both is those insects which we have already described; and both are peaceable and innocent, though qualified by their strength or their arms to spread general destruction*.

So little does this fish avail itself of those implements with which nature has provided it, that they appear rather an impediment, than a means of defence. It is at no pains to keep them in repair for action; but on the contrary, the tooth is constantly seen covered with weeds, slime, and all the filth of the sea. In one instance they evidently operate to the destruction of the owners; for the narwhals being gregarious animals, they are no
fodder

* Goldsmith's Nat. Hist.

THE NARWHAL

sooner attacked by a fishing vessel, than they crowd together in such a manner, that they are mutually embarrassed by their tusks, and are prevented from sinking to the bottom. In this situation the harpooners seldom fail of striking one or two of those that are longest detained upon the surface of the water; and the quantity of the oil which they produce, renders their capture an object of very considerable emolument.

SECTION III.

GEN. III. *The Cachalot.*

THE fishes of this genus are not of such an enormous size as those last described: They are, when full grown, from fifty to sixty feet long, and sixteen feet in thickness. Their heads are still more disproportioned to the size of the body, than that of the common whale: in the latter animal it is equal to a third of the body; in the former it constitutes an half. The cachalots are distinguished from all the other cetaceous tribes, by having sharp arcuated teeth in the lower jaw: Their bodies being more slender, they are more active than the *Greenland* whale; are capable of remaining longer at the bottom; and yield a smaller quantity of oil. The tongue is commonly small, but the mouth and throat are so capacious that the animal could easily swallow an ox*. The teeth are about seven inches long, exceedingly thick and hard; they enter, when the mouth is shut, into a number of cavities in the upper jaw prepared for their reception†.

This

* Goldsmith's Nat. Hist.

† British Zool. Class iv. Gen. 2.

This formidable conformation of the mouth and throat seems to indicate an extraordinary degree of voracity in these animals. The history of the cachalot corresponds to these appearances: for while the stomach of the whale is seen to contain hardly any thing but froth, that of the cachalot is crammed with a variety of different kinds of fishes; some half digested, others whole[§]; some small, others eight or nine feet long. The cachalot, therefore, is probably one of the most rapacious fishes of the deep: and is as destructive among the lesser tribes, as the whale is harmless. But it is not to the smaller fishes alone, that this animal is formidable; among these the contest is soon ended, for it can devour thousands at one swallow; it pursues and terrifies those of its own order, the dolphin, and the porpessæ to such a degree, that they are frequently driven ashore in endeavouring to escape.

Of the cachalot there are no less than seven varieties: That of a black colour, with two fins; the cachalot with a white back, and the same number of fins; the species with its spout-hole in the neck; that with the spout near the mouth; that with three fins, and sharp pointed teeth; that with three fins, and sharp edged teeth; and, lastly, the cachalot with three fins, and flat teeth. All these were indiscriminately termed spermaceti whales*, till Mr. Pennant borrowed that name from the *French*, by which they are now distinguished†.

From the smallness of its size, as well as its fierceness and agility, the capture of the cachalot would seldom be attempted by the fishers, were it not for the sake of those valuable medicines, spermaceti and ambergris,

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which

* Dale's Harwich. p. 413.

† Vide Brit. Zool. Class iv. Gen. 2.

THE CACHALOT.

which these animals have been found to contain. The various purposes to which these substances are applied, both as drugs and articles of luxury, have rendered the cachalot, which supplies them, a fish in great request, and its capture the most advantageous object in the *Greenland* trade.

Spermaceti is the name erroneously given to that substance which is found in the head of the cachalot, and which is by no means the semen, but the brain of the animal. *Goldsmith* gives the following account of the method by which it is extracted*. The outward skin of the head being taken off, a covering of fat appears, about three inches thick; and under that, instead of a bony skull, the animal has only another thick skin, that serves for a covering and defence of the brain. The first cavity or chamber of the brain, is filled with that spermaceti which is supposed of the greatest purity, and is of the highest value. From this cavity there is generally drawn about seven barrels of the clearest spermaceti, that, thrown upon water, coagulates like cheese. Below this there is another chamber, just over the gullet, which is about seven feet high; and this also contains the drug, but of less value. It is distributed in this cavity, like honey in a hive, in small cells, separated from each other by a membrane like the inner skin of an egg. In proportion as the oily substance is drawn away from this part, it fills anew from every part of the body; and from this is generally obtained about nine barrels of oil. Besides this, the spinal marrow, which is about as thick as a man's thigh, and reaches all along the back-bone to
the

* Nat. Hist. vol. vi. p. 218.

the tail, where it is no thicker than one's finger, affords no inconsiderable quantity.

Formerly the spermaceti was obtained but in small quantities, and was sold at a very high price, from the supposition of its great efficacy as a medicine. Though it still enters into the compositions of the apothecary, yet it is rather to give a consistency to his medicines than to add to their virtue: and since the art of converting the whole oil of the cachalot into spermaceti by boiling has been discovered, the article has decreased rapidly in its value. It has now fallen below the price of wax, and is used instead of it for candles.

Ambergris is the other medicine, for which mankind are indebted to the cachalot; and this substance, rather than the former, should have obtained the name of spermaceti, because it is found in the place where the seminal vessels of other animals are commonly situated. For a long time the world was taught to believe, that ambergris was a substance to be found only in small quantities upon the surface of the water. The trade in these articles was originally in the hands of men of obscure and suspicious characters; and this was one of the arts by which they endeavoured to add to the mysterious nature, and value of the commodity. Time, which reveals the secrets of the mercenary, has at last discovered that this medicine is the produce of the cetaceous fishes *.

Among the intestines of the cachalot is found a bag three or four feet long, filled with liquor of a yellowish colour, and thinner than oil; and in this fluid, the ambergris is seen floating in round lumps, from one to twenty

* Goldsmith's Nat. Hist. ubi supra.

ty pounds weight, and never above four in the same fish. These balls of ambergris, the purposes of which, in medicine and perfumes, are so well known, are not indiscriminately found in every fish: it is only the oldest and strongest that yield it in any considerable quantity.

The Blunt Headed Cachalot.*

THIS species sometimes visits the coasts of *Britain*: A dead one was cast ashore near *Edinburgh* in the year 1769, which measured fifty-four feet, from the mouth to the tail; and its greatest circumference was thirty feet†.

The head of this animal is of an enormous size, far exceeding the proportions of the whale. The upper jaw projects five feet beyond the lower; and its length is about fifteen feet, the other being only ten. Near the snout, which is quite blunt, and near nine feet high, is placed that orifice peculiar to the cetaceous order, by which they spout the water. The lower jaw is armed with forty-six teeth, all pointing outward to meet the sockets, where they enter into the upper. The teeth are about seven inches in circumference at the bottom, sharpening as you approach the top; they are all bent, and like the teeth of the other cetaceous fishes, they are
white,

* Le cachalot a dents en faucilles. Brisson, *Phyſiter. Microſp. Lin. Syſt.*

† *British Zoology*, class iv. gen. 2.

white, and polished like ivory. Far back, and towards the hind part of its monstrous head are placed the eyes, which are very small in proportion to the size of the animals whose motions they are intended to direct. The back fin of this species is wanting, and in its place there is found a large protuberance: The two pectoral fins are placed hard by the corners of the mouth, and are about three feet long. The penis is seven feet and a half; the tail bifurcated, and fourteen feet from tip to tip. Such are the monstrous dimensions of this unshapely animal. In its great outlines we still recognize the general characters of the order; and though inferior in size to the whale, it is far more tremendous in its aspect, and fiercer in its manners*.

The round headed Cachalot †:

THIS fish is described by *Sibbald* †, who mentions a shoal consisting of an hundred and two that was cast on shore at the same time upon the *Orkney* isles. According to that writer, it wanted the spout-holes, that are reckoned characteristic of this order of fishes; it is probable, however, that what he has described as nostrils, was this

* *Vide Phil. Transact.* vol. LX.

† *Physiter Catodon.* Lin. Syst. *Le Petit Cachalot.* Brisson.

‡ *Sib. Phalain.* ix.

this opening, which nature, as we have already seen, has destined for a different purpose.

This species is far inferior in size, to that above described; the largest of that great number just mentioned did not exceed twenty-four feet in length. Its head is round, and the shape of the teeth the reverse of those of the blunt headed kind. They are smaller at the back, than at the top, where they are quite flat, marked with concentric lines. Their bottom is pierced with a small orifice, bearing no resemblance to the large cavity, described in the former species. The back fin is wanting; instead of it is a rough knotty kind of space*.

* British Zoology.

SECTION IV.

GENUS IV.—*The Dolphin.*

IN reviewing the different tribes of cetaceous fishes, we find them, in proportion as they diminish in size, growing still more active and voracious. The fishes of this genus, which comprehends in it three different families, that of the dolphin, the grampus, and porpessæ, are all much less in bulk, than the common whale. They have all fins upon the back, and like the rest of the whale kind, they have heads disproportioned in size to the rest of the body. Each of the three species have both jaws armed with formidable teeth; for nature has not conferred upon them an extraordinary voracity, without bestowing the means of gratifying it.

From their great agility, the fishes of this genus are not frequently taken. They seldom remain a moment above water; sometimes, indeed, their too eager pursuits expose them to danger; and a shoal of herrings allures them out of their depth. In this situation, the wretched animal continues to bounce and flounder in the shallow water, till it is knocked on the head, or till the returning tide again comes to its relief. The porpessæ are often allured up the *Thames* in this manner, till they are surrounded with

with boats, from which the fishermen shoot them with fire arms*.

In their internal structure these animals resemble quadrupeds, and the other cetaceous fishes. Conception is begun by the introduction of semen, and after ten months, a perfect animal is produced. They bring forth their young only in the summer season †; in the month of October the fœtus has been extracted from a dolphin but newly begun to form ‡. The young, after being produced, continue to follow the parent, till they have attained their full size, which is in about ten years. The longevity of these fishes was computed by *Aristotle* to be upwards of thirty years: The method practised to ascertain it, seems but an aukward one: it was, by cutting off a part from the tail fin, and returning the animal to the sea; and if the fish happened afterwards to be taken, its age was guessed at from that circumstance.

The Dolphin §.

CONCERNING the figure of the dolphin, properly so called, the ideas of the ancients were exceedingly erroneous. Upon their marbles and coins, they are uniformly designed of

* Goldsmith's Nat. Hist.

† Mistot. Hist. anim. lib. vi.

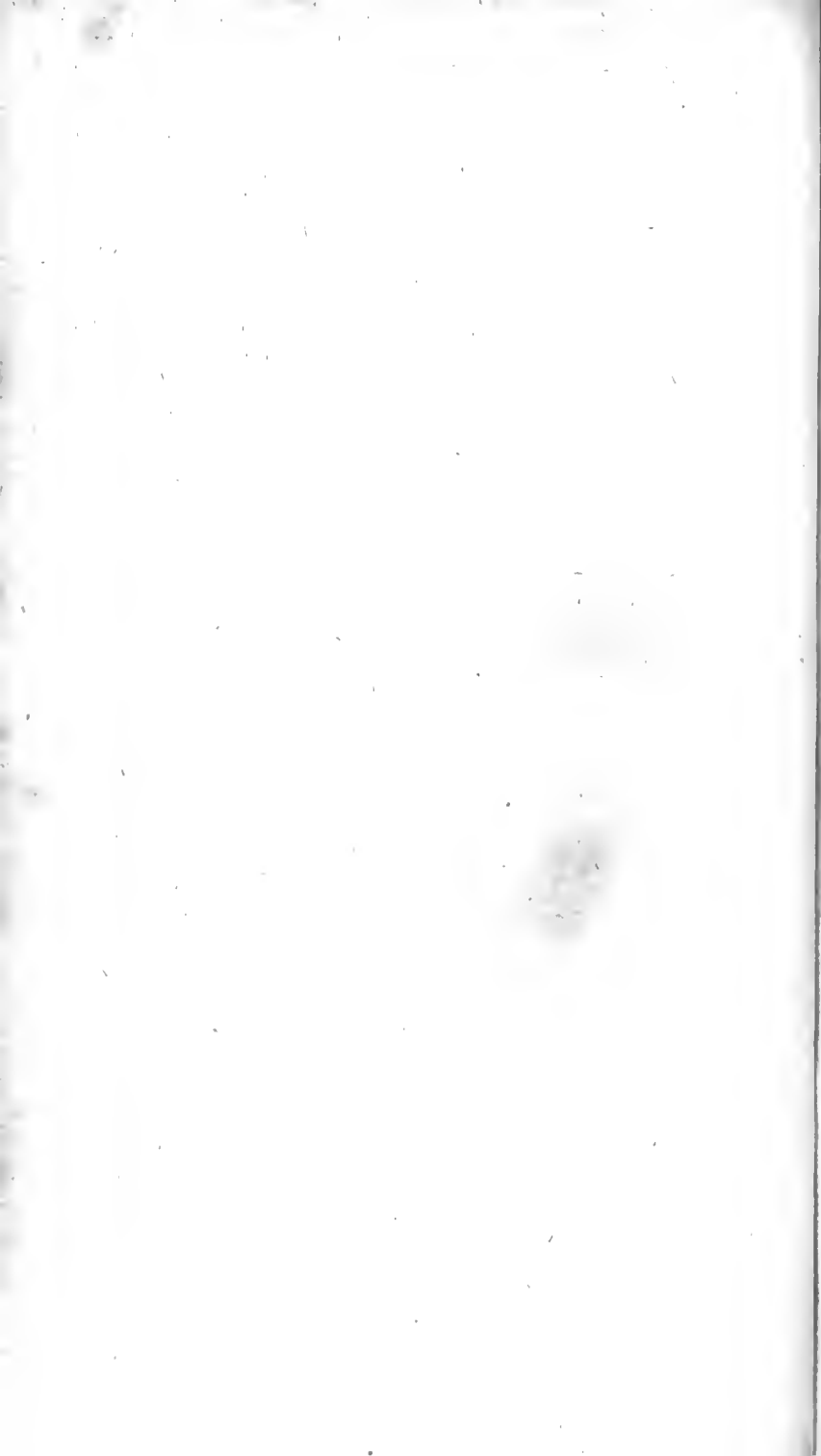
‡ Willough. lib. ii. p. 30.

§ Delphinus Antiquorum. Willough. Le Dauphin. Brisson.

Plate II.



DOLPHIN



of a crooked form : From the descriptions of the poets, it appears that they entertained the same inaccurate notion of the shape of this animal *. Before a storm the dolphins are observed to be in great commotion, and frequently to leap above the surface of the water. It is probably in this attitude, almost the only one in which they were then seen, that they have a crooked appearance to the eye †. The natural shape of the dolphin is almost straight, the back being very slightly incurvated, and the body slender.

But it is not in the external form alone of the dolphin that the ancient writers were mistaken : Their philosophers and historians seem to have contended who should invent the most extravagant fables concerning it. This fish was celebrated in the earliest time for its fondness of the human race. It does not dread man, says *Pliny*, as a stranger ; but comes to meet him in the ship, and to sport around the vessel : hence it was distinguished by the epithets of *boy loving*, and philanthropist ‡. It was consecrated to the gods ; and therefore was honoured with the title of *sacred* fish. Various are the services which this race are said to have performed to man : *Pliny*, *Aelian*, and many of the other early writers set no bounds to their belief of the tales related concerning the dolphin's attachment to the human species : *Pliny* the younger, who lived in an age less remarkable for credulity, makes an apology for the story of the enamoured dolphin of *Hippo*, which he narrates in a beautiful manner §.

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From

* Tumidumq; pando transilit dorso mure. *Sene.* Tr. g. *Agam.* 459.

† Bellonius apud Willough. p. 30.

‡ British Zoology, vol. iii. p. 65.

§ *Vide* Epist. lib. ix. ep. 33.

From what cause the ancients were prejudiced in favour of the dolphin it is not easy to determine. The figure is such as could create no partiality; its manners, which are fierce and rapacious, could still less endear it; and it does not appear that this fish shews any attachment to mankind, more than the rest of the cetaceous tribes. It perhaps has arisen from commiseration, on hearing that plaintive moan, by which, when taken, it expresses its sufferings. In a vessel where several dolphins were confined, says an old writer, I spent a night of great pain and uneasiness, so feelingly did these wretched creatures express the miseries of their condition, in cries and lamentations, resembling the human. Their sufferings forced from me tears of compassion; and while the fisherman was asleep, I forced the one that seemed to suffer the greatest agony overboard into the sea. This act of tenderness availed me nothing; for the moaning of those that remained behind, seemed only to be increased; who made signs too plain to be misunderstood, that they wished for a similar deliverance. Thus I spent the night in unavailing sorrow for sufferings that I could not alleviate*.

These prejudices in favour of the dolphin, are now so wholly obliterated, that even the common people regard them in a very different light. Their appearance is far from being deemed a favourable omen by the seaman; for their boundings, sports, and frolics in the water, are held to be sure indications of an approaching storm†. It is not known whether these motions of the dolphin are the gambols of pleasure, or the effects of fear. They probably

* Gillius apud Willoughb. page 31.

† British Zoology, and Willoughb. lib. ii. p. 30.

bally are occasioned by some presentiment of that turbulence and commotion which is soon to take place in their element; a commotion which obliges the smaller fishes to sink to the bottom, and which of course deprives them of their accustomed prey.

Almost every thing marvellous in natural history disappears on farther acquaintance, and more accurate examination of the subject. This has been the fate of all those extraordinary circumstances related of the dolphin. So great is the number of those animals that play around this island, and so frequently are they taken, that experience and ocular testimony, soon contradicted those tales that had been the growth of credulity and ignorance.

The swiftness of these animals in the pursuit of their prey, and their extraordinary avidity to secure it, are almost the only peculiarities (if such they can be called) which farther experience has ascertained to belong to them, or at least to characterise their manners. *Belon** long ago remarked, that they easily came up with the ship in which he was, though in full sail before a brisk gale; and that they played around her, with a velocity resembling that of a bird in the air. This extraordinary swiftness of the dolphin seems to be the combined effect of agility and strength: by means of it they are enabled to make dreadful havoc among the salmon, herring and mackrel. They are frequently seen fighting pitched battles with the *amie*†. The two different kinds of fish range themselves on each side, like contending armies. In one of these engagements, at the opening into the *Dardanelles*,

* Hist. Piscium.

† A fish in the Mediterranean resembling a salmon.

danceller, the *amie* were vanquished, and put to a total rout by their victorious enemies *.

The dolphin, like some other kinds of cetaceous animals, have been observed to emigrate from one sea to another. They have been known to pass from the *Mediterranean* into the *Black Sea*; and after having remained for some time there, to return to their former haunts. When they are taken, as sometimes happens, in the nets placed for other fishes, if they are not strangled by their own efforts to escape, they will live for a long time after being brought to the shore: One has been carried alive from *Montpellier* to *Lyons* †.

In former times the flesh of the dolphin was reckoned a great delicacy: it was bought by princes at a high price, and presented at their most formal entertainments. This *Rondeletius* declares, he had more than once observed, though not among his own countrymen, where the practice of eating these fishes had entirely gone into disuse. This was also the case in *England* in the days of *Willoughby* ‡. At a more ancient period, however, these fishes were not only eaten, but held in as high repute among the *English*, as any other nation. Dr. *Caius* says, that one which was taken in his time, was thought a present worthy of the Duke of *Norfolk*, who distributed part of it among his friends. It was roasted and dressed with porpess sauce; a composition of fine white bread mixed with vinegar and sugar §.

The snout of the dolphin is narrow and pointed, not
unlike

* Hist. Piscium.

† Vide Gesner and Rondeletius.

‡ Vide Hist. Piscium lib. ii. p. 31.

§ Caij opuscula, p. 116.

unlike the beak of some birds; and hence the *French* call it the sea-goose *. Its teeth are forty-two in number, placed in both jaws, and bended a little towards the mouth. They are placed at such a distance, that each tooth enters into a space between two in the opposite jaw.

The skin of these fishes is smooth, of a dusky colour on the back and sides; while the belly is white. The form of the tail is semilunar; that of the back fin, high, triangular, and placed nearer to the tail than the head †

The Porpoise ‡.

THE fishermen do not distinguish this fish from the dolphin, which it nearly resembles: Both are known by the name of porpoise among the *English* sailors; and the *French* with indiscrimination call them *marfouins*. The latter word is derived from the *German*, and the former from the *Italian* language: the import of both is the same, and expresses the resemblance which this fish bears to a hog §. It is probably from the particular shape of the nose, that the animal has obtained this name so generally among the modern nations of *Europe*. The snout projects considerably, though not so long as that of the

* British Zoology, L'oise de la mer.

† Idem, Class iv. Gen. iii.

‡ Le Marfouin. Brisson Delphinus Phocaena, Lin. Syst.

§ Meerfchwain denotes a sea-swine, and Porcopecce may be translated hog-fish.

the dolphin: It is furnished with very strong muscles, which enable the fish more readily to turn up the sand; for by this means the porpesse, as well as the swine, procures a great part of its food. When prey fails at the surface, it dives to the bottom in search of sea worms, and sand cels which it digs up there.

The porpesse is distinguished from the dolphin, by the superior thickness of the head, as well as the shortness of the nose: It is commonly of smaller size; the body gross and fat towards the head, but tapering away in the form of a cone, till it becomes slender at the tail*. The colour of the back is generally black, and the belly white: This, however, is not an uniform character; for in the river of *St. Lawrence* there is a white porpesse; and there is in the *British* channel a small species called thorn-backs, that are various, sometimes brown, white and spotted†.

Both jaws of the porpesse, as well as those of the dolphin, are provided with teeth; but in the former they are much more numerous, and of a smaller size than in the latter animal. They are forty-eight in all, moveable, and so situated as to lock into each other. The eyes are small, resembling those of the human species, both in size and in the distribution of their humours‡. It has no branchiæ, nor any aperture in their place; the spout-hole is upon the crown of the head, of a semilunar shape, and divided internally by a cartilaginous membrane, which appears at the summit of the head like the comb of a cock.

Towards the nose of this animal there have been observed

* Willough. Hist. Pisc. page 23.

† British Zool. class iv. gen. 3.

‡ Dan. Major apud Willough.

served no less than six concealed apertures or *foramina* leading to the brain, which have been supposed to be its organs of smell; a sense which it probably possesses in a greater degree than other fishes.* The tongue is flat, pectinated at the edges, and fastened down to the bottom of the mouth †.

The structure of the viscera of this fish appears more complex, and indicates an organization somewhat superior to the rest of the tribe; we are persuaded however, that a more minute examination of the parts would discover an exact conformity between it and the different cetaceous tribes. The porpesse, according to *Willoughby* ‡, has three stomachs: the first, large, wrinkly and muscular, for reducing the shells of fish which it devours; the second was also large, empty, and furnished with smaller muscles; the third appeared a kind of adjunct to the other two, and contained a quantity of assimilated chyle, of a livid colour.

The whole body of the porpesse, immediately below the skin, is covered with a coat of fat resembling lard, of an inch thick. Various uses, in the economy of the animal, are assigned to this substance: it is supposed to defend the body from injury and cold; to diminish its weight so as to make it equiponderate with the water, in order that the fish may alternately rise and sink without effort, while employed in the different operations of breathing and collecting food. Beneath this coat of fat lies the flesh, red, thick, and muscular, resembling that of a hog §.

Of all the cetaceous fishes, the porpesses are found in
greatest

* *Dan. Major apud Willough.* † *British Zool. ubi supra.*

‡ *Hist. piscium*, page 33.

§ *Idem ubi supra.*

greatest abundance around the *British* isles. In such vast numbers do they appear in some places, that the fishermen are not safe to venture among them in a small boat. When gamboling upon the summit before a storm they appear almost to darken the surface of the water *. In times of fair weather, they are seen herding together, and pursuing the shoals of mackrel with great impetuosity. Their manner of hunting after their prey is distinguished by the same eagerness and disposition to act in concert, that is observable among dogs when pursuing a hare †. They are seen urging them from one bay or creek to another, deterring them from the shallow water, and driving them towards each other's ambush, with all the art of an experienced greyhound.

The Grampus ‡.

THIS animal seldom exceeds the length of twenty-five feet, but is remarkably thick in proportion, the breadth being to the length, as ten to eighteen. It was with reason that *Pliny* called it an immense heap of flesh, armed with dreadful teeth §. From its resemblance to a wine cask in the thickness and rotundity of its form, it obtained the name of *orca* among the ancients.

The nose of the grampus is flat, and turned up; the
under

* Pennant's Brit. Zool.

† Goldsmith's Nat. Hist.

‡ L'Epaulard, Brisson. Delphinus Orca, Lin. Syst.

§ Cujus imago nulla representatione exprimi potest alia, quam carnis immensæ dentibus truculentis. Lib. ix. cap. vi.

under lip is so thick and heavy, that when the animal is on its belly, it is separated from the upper *. The teeth are sixty in all, thirty upon each jaw; and between each is a space adapted to receive those of the opposite side, when the mouth is shut †. Those upon the fore parts are blunt, round, and slender, the innermost sharp, and of great thickness. The spout hole in this species, is placed at the top of the neck; the animal is covered with a strong skin, like leather, black upon the back, but displaying a large spot on each shoulder, of the same colour with the belly, which is white; the sides are marbled with black and white spots ‡.

The grampus is of all the cetaceous fish the most fierce and voracious; it does not even spare the porpessæ and whale, which are animals of its own order and of superior size; the latter of these fish it is said to tear and mangle in such a manner with its teeth, that it bellows like a bull from the pain of its wounds ||. The fishers who formerly repaired to the coasts of *America*, prohibited the savages from destroying this fish; for by its assistance they were aided in the capture of whales, seals, and other animals: whilst the grampus pursued these, and the other monsters of the deep, they were frequently obliged to betake themselves to the shallow water, in order to escape its merciless teeth, where the seamen were ready to kill them with javelins and harpoons.

This species is a profitable capture for the fishers, as it is said to yield a very considerable quantity of oil; like the porpessæ, it sometimes appears upon the *British* coasts;

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coasts;

* Vide Will. Orca. Lib. ii. p. 40.

† Sibbald, Phalæn. 7, 8.

‡ Brit. Zool. Class iv. gen. iii.

|| Willough. ubi supra.

coasts ; but its great resort is off the *North Cape* of *Norway*. The number and position of the fins are the same as in the dolphin ; and it resembles all the other cetaceous animals in swimming against the wind, and in that tumbling and agitation which it discovers on the approach of a storm.

CHAPTER V.

SECTION I.

General Characters of the Cartilaginous Fishes.

IN the organs prepared by nature for the respiration of animals, there is a great difference between those formed within the body, called lungs, and that apparatus at each side of the head, known by the name of gills. Among all the terrestrial animals, and the cetaceous fishes, breathing is performed by the former of these contrivances, and among the spinous fishes it is carried on by the latter ; between these two orders of the animal kingdom, there is placed a third, which unites them in the great scale of being, and partakes in some measure of the nature of each. These are the cartilaginous fishes, which, while they are furnished with apertures on each side of the neck, corresponding to the gills of the spinous fishes, are also supplied with lungs within the cavity of the body, analogous to what we have already seen among the terrestrial and cetaceous tribes.

From this double conformation in the organs of breathing, it would at first view appear, that the cartilaginous tribes were a kind of privileged order of animals, possessing a greater variety of endowments than the rest of

the animal kingdom. It would appear that they are capable of subsisting indiscriminately in either of these two elements, to each of which the structure of their parts seem to have a reference; it was no doubt this aspect of the cartilaginous fishes, which presented itself to *Linnaeus* when he arranged them in the same order with those animals, properly amphibious *, that are capable of subsisting either in the water or in the air. Of this power, however, this class of beings is by no means possessed; for, though they are capable of supporting life for a longer time on shore, than the spinous fishes, yet there is hardly any of them that can live there above a few hours at a time †. Whatever, therefore, be the structure of their organs, there is none of them properly amphibious, or that justly merits a place among that order of beings.

But although the double structure of the organs of respiration in the cartilaginous fishes, will not justify us in placing them among the fishes, tortoises, lizards, and other animals that are strictly amphibious, it forms, however, a very palpable mark of distinction between them and the cetaceous fishes on the one hand, and the spinous upon the other; from the latter they are known, because, though they have apertures corresponding to gills, they universally want the bony *opercula* which covers them ‡.

These apertures by which they breathe, are placed always near the head, but have not uniformly the same position: In some they are placed beneath, as in the rays, and other flat fish; in others on the sides, as among the shark

* He has termed them *amphibia nantes*. Vide *Systema Naturæ*.

† Willough. Ichthyol.

‡ Pennant's Brit. Zool. Class iv. Div. ii.

shark tribe; and among a third class, they are situated on the top of the head, as exemplified by the pipe fish.

From these foramina, there are two bending cylindrical ducts, that run to the lungs, and are supposed to convey the air that gives their organs their proper play: The heart, however, has but one valve; and hence, their blood does not perform that double circulation which obtain among the cetaceous kinds, and the lungs seem rather an internal assistant to the gills, than for supplying the same purpose which they do in quadrupeds, for they want both the pulmonary vein, and artery.

Another striking character by which this order of the animal kingdom may be distinguished, is, that their flesh is supported by cartilages instead of bones. In the cetaceous tribes we have seen, that the bones were hard, and filled with marrow, resembling those of quadrupeds, while these parts in the spinous tribes, are small, slender, and pointed, resembling thorns, and generally solid throughout. The size of other animals increases with their age, and stops at a certain point; but from the pliancy of the bones in this tribe, they seem to have no bounds placed to their dimensions, and it is supposed that they grow larger every day till they die †.

A third general character of these fishes arises from their manner of generation; some of them are oviparous, while the greater part produce living young; the same duplicity of character attending them in this respect, which we have already taken notice of with regard to their conformation. In those that are viviparous, the progeny is excluded from an egg hatched within the body

† Goldsmith's Nat. Hist. vol. ii. p. 235.

dy of the female ; this egg consists of two parts, the white and red, as in those of birds, and instead of a shell, it is lodged in a case formed of a thick tough substance, resembling a horn that has been softened in boiling water *.

The oviparous fishes of this class produce their young nearly in the same manner ; in these as well as in the viviparous kinds, the egg is hatched for some time in the belly of the female, but before the fetus is disengaged from it, is excluded from the womb, and left till time and the warmth of the sun bring the inclosed offspring to maturity. Both differ remarkably from the whales and the quadrupeds, whose eggs start from the ovarium, and enter the uterus at the time of conception, where they remain only a few days, till they leave that state, and are formed into a complete fetus.

There are other discriminating characters belonging to this order, less discernible indeed, but such as mark a difference between them and the adjoining tribes. The spinous fishes we saw had no apparatus for hearing ; it is probable, however, that the cartilaginous are furnished, though imperfectly, with the organs of this sense ; upon each side, near the eyes, there is an aperture which opens into the mouth, the supposed use of which is partly to convey the water into the mouth, which is expelled through the gills, and partly to convey sounds to the sensorium †. In this respect, therefore, the cartilaginous fishes may be deemed a more accomplished race than many of their companions of the deep.

The

* British Zool. ubi supra.

† Will. Ichtyol. Lib. iii. p. 45.

The fishes of this order are possessed both of gills and lungs, and are thereby in some measure capable of deriving aid from both elements, to their necessities and enjoyments; the manner of their parturition is also various: and we are now to contemplate them in the double enjoyment of another qualification. The males of this race copulate with their females, *more hominum*; and in them the external organs of generation are two-fold *. These instruments project forward from each side of the abdomen; and whether it be that these animals possess more warmth of constitution, or a greater capacity of bringing their offspring to maturity, they generally choose colder seasons and situations for producing their young, than other fishes; many of them propagate in the midst of winter, and far from the shore †.

The cartilaginous fishes, though not so remarkable either for fatness or size, are in general more voracious than any of the tribes we have already reviewed; their livers are indeed fat, and are sometimes employed for the production of oil; it is not, however, from them that man derives either his most pleasant or salubrious food; they are impure and immoderate feeders, and their flesh favours of that impurity ‡. Of a considerable portion of them, the mouth is placed below the head; a contrivance of Nature, for which an old writer assigns some curious reasons: Their snout, says he, is too small to be divided; and their voracity is so keen, that their own life requires that it should not be allowed a ready or complete gratification §.

From

* Idem ubi supra.

† Goldsmith's Nat. Hist.

‡ Will. Ichthyol. Lib. iii. p. 45.

§ Vide Rondeletius de piscibus, Lib. iii. cap. 4.

From this conformation of the mouth, a great part of the cartilaginous fishes are obliged to turn their back downwards in laying hold of their prey ; a circumstance that requires time, and affords an opportunity to the smaller fish of making their escape. They devour every kind of fish or flesh, and to their extraordinary voracity, had Nature granted the power of easily apprehending their food, the other kinds of fish must long ago have fallen a sacrifice to their gluttony *.

* Idem ibidem.

SECTION II.

GENUS V.—*The Lamprey.*

OF this genus, *Linnaeus* has enumerated only three species, though it is probably diversified into a greater number of different kinds *; his catalogue consists of the sea lamprey, the river or lesser lamprey, and the pride. He makes mention of the *muræna*, that fish so much celebrated among the epicures of ancient *Rome*, although so nearly allied to this genus, that it seems to merit a place there. There is a species of lamprey esteemed a great delicacy by the modern inhabitants of *Italy*, different from ours, and probably the same fish with the ancient *Muræna*, as it is reared in ponds, and fed in the same manner. The genuine characters of these fishes are : A long and slender shaped body, resembling that of a snake ; the skin has no scales, but is covered with a slimy glutinous mucus ; they have seven apertures for breathing upon each side, and one like the cataceous fishes upon the top of the head ; both the pectoral and ventral fins are wanting.

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* Vide *Syst. Nat.* p. 394

The Muræna *.

THIS species, we are told, obtained its name from its continually floating upon the surface of the water, by reason, as was supposed, of its extraordinary fatness †. In shape it resembles an eel; the snout more protuberant, sharp and compressed: Its colour variegated with shades of yellow, brown, and black. The head is small, but the opening of the mouth capacious. The margin of each jaw is surrounded with a single row of very small teeth: upon the snout there are two apertures, and above the eyes other two; the former, as is supposed, are the organs of smell, and the latter of hearing ‡. The ancients believed that this animal was endowed with a very acute sense of hearing, and that the fishermen could allure it to the brink of the water by hissing, and by that means take it §.

Like the other fishes of this genus, it wants the pectoral and ventral fins; but a little beyond the head there arises a fin, which stretches along the back to the tail, and turns round to the belly, terminating at the anus: This fin is covered with the common legument of the body, and is easily laid bare by flaying the animal.

The bite of the muræna was deemed so poisonous by the fishermen, that in taking the animal, they used every precaution to prevent its effects: They tumbled them immediately

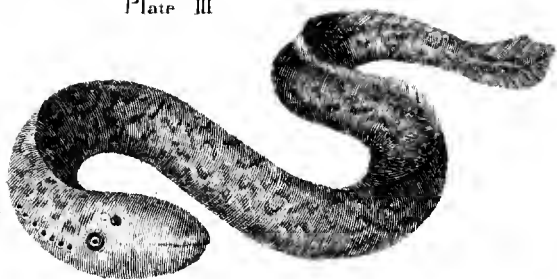
* *Muræna omnium auctorum.* Will. Ichthyol.

† *Παχα το μυρίον.* Vide Macrob.

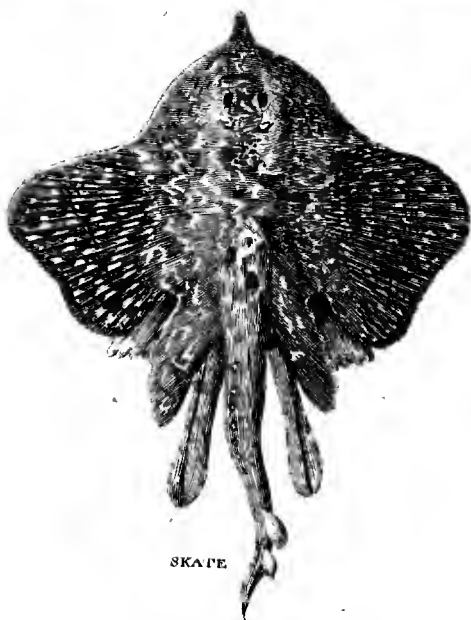
‡ Will. p. 103.

§ Plinii. Hist. Nat.

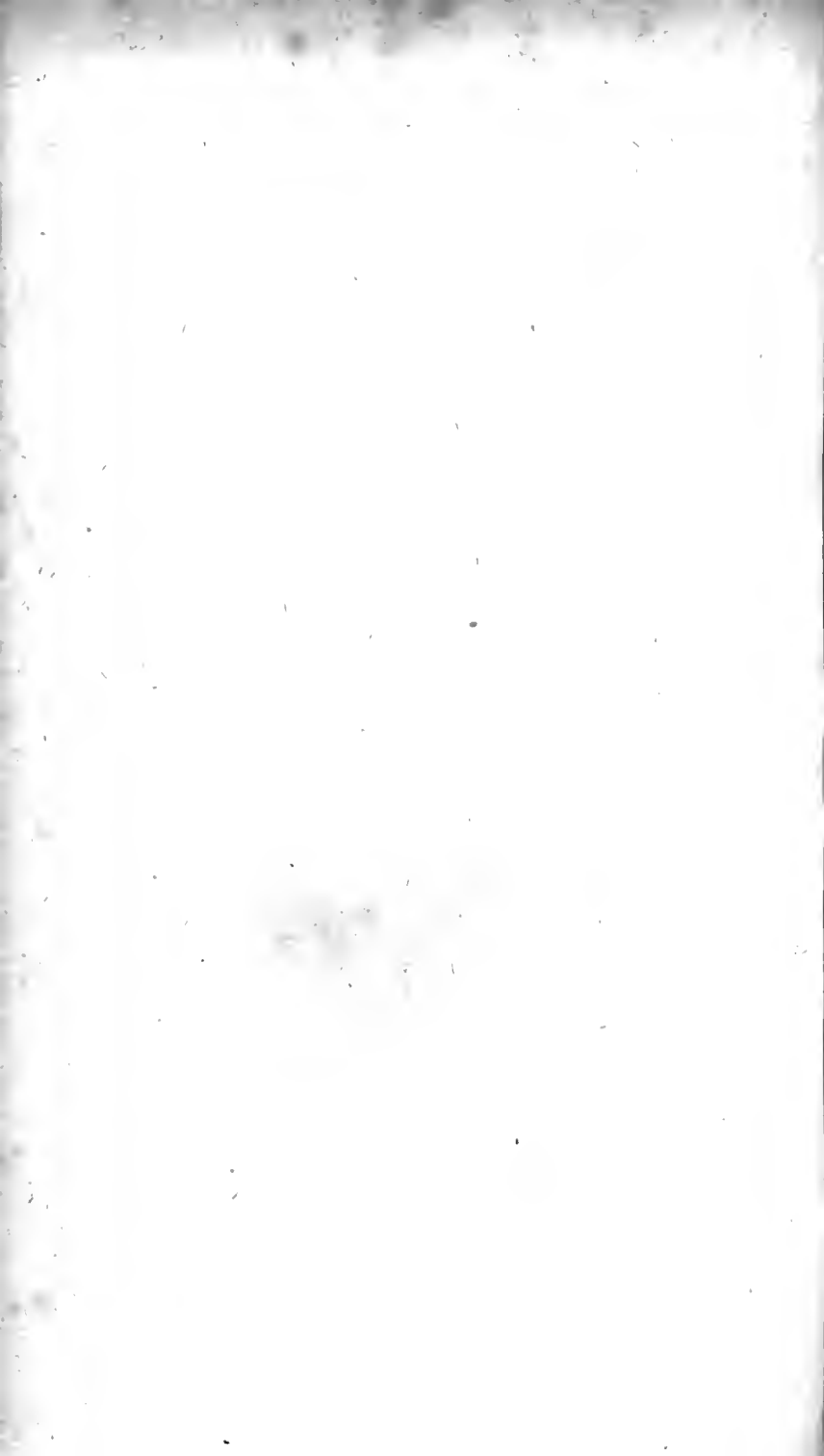
Plate III



LAMPRIES



SKATE



Immediately from the net into the boat, where they laid hold of the head with a forceps, rubbed its snout against some hard substance to destroy its teeth, and beat it on the tail, where the life was supposed to lie *. That the principle of life, among eels in general, is placed in the tail, is still a prevalent opinion; and when taken, it is not by beating the head, but the tail, that the fisher endeavours to deprive them of animation.

Poisonous as the bite of these animals may be, and hideous in their external figure as they certainly are, yet these circumstances did not prevent the luxurious citizens of ancient *Rome* from adding them to the endless list of delicacies with which they pampered their appetites †. This species, the bassie (*Lupus*), and a kind of mullet (*Myxo*), formed that pride of *Roman* banquets, the *tripatimam*; so called, according to *Arbuthnot*, from their being served in a machine of three bottoms ‡.

The flesh of this animal must be various, according to the manner in which it is fed; it is said, however, to be in general white, tender, and of an agreeable flavour§. It was reared with much care in the fish ponds of *Italy*, and sold at a high price; of its estimation among the ancients, we have full evidence in all the classics, that have either praised good eating, or ridiculed gluttony. A senator of *Rome*, whose name will be transmitted with infamy to posterity, was highly complimented for the delicacy of his *murænæ*. *Tigellinus*, *Manucius*, and all the celebrated epi-

M 2

cures

* Plinii Hist. Nat. lib. 32. cap. 2.⁴

† Pliny, Ovid, Juvenal and others.

‡ Atque ut luxu quoque aliqua contingat auctoritas figlinis *Tripatinam*, inquit Fænestella appellabatur, summa cœnarum lautitia: Una erat *Murænerum*, altera *Luporum*, tertia *Myxonis* piscis. Plinii Hist. Nat. lib. 35. cap. 12.

§ Willough. lib. 3. p. 104.

cures of his time, were loud in his praises: No man's fish had so rich a flavour, were so nicely fed, or so exactly pickled. *Augustus* hearing so much of this man's entertainments, desired to be his guest; and soon found, that fame had been just to his merits; the man had indeed fine murænæ, and of excellent flavour. The Emperor was desirous of knowing the method by which he fed his fish to so excellent a relish; and the glutton, making no secret of his art, informed him that his way was to throw into his pond such of his slaves as had at any time displeased him. *Augustus*, it is said, was not much pleased with his receipt; and instantly ordered all his ponds to be filled up. *Goldsmith*, who narrates this story, adds, that it would have ended better, had he ordered the owner to be flung in also*.

The Sea Lamprey †.

THIS is a *British* fish, of which the names *lampetra*, and *petromyzon*, lately given it, are expressive of a habit this animal possesses of sucking and adhering to stones ‡. The mouth is of a round form, placed rather obliquely below the nose, and resembling that of a leech. Like that animal, it possesses the extraordinary power of sticking to any substance to which it is applied; and that with such firmness, as not to be drawn off without some difficulty.

* *Goldsmith's Nat. Hist.*

† *Petromyzon Marinus. Lin. Syst. La Lamproye de Mer. Belon.*

‡ The first *lampetra*, a *lambendo petras*; and the other, from *λιγος* and *μύξα*, because they are supposed to lick the rocks.

culty *. One that weighed but three pounds, has been known to adhere so firmly to a stone of twelve pounds, that it remained suspended at its mouth. This amazing power of suction must arise from the animal's exhausting the air within its body by the hole over the nose; while the mouth is closely fixed to the object, and permits no air to enter †. The weight which the lamprey is by this means able to sustain, will be equal to that of a column of air of the same circumference with the animal's mouth.

The lamprey sometimes grows so large, as to weigh four or five pounds; its colour is dusky, irregularly marked with dirty yellow. In the mouth are placed twenty rows of small teeth, disposed in circular orders, and placed far back near the throat, four, five, and six, in each row ‡. The branchiæ are situated within the seven apertures, that are found on each side of the neck. Though in shape this animal resembles an eel, yet it is of a thicker and more clumsy form.

The sea lamprey, we should imagine from its name, was only produced in the salt water; it is found, however, very frequently at the opening of large rivers, where they join the ocean. At certain seasons it is found in many of the *British* rivers, and also in the *Irish*. They are sea fish; but, like salmon, quit the salt waters, and mount the rivers about the end of winter, and after remaining there for a few months, return again to the ocean §.

As our manners are probably still far short of that sensuality and extravagance which distinguished the ancient

* Pennant's *British Zoology*. † Goldsmith's *Nat. Hist.* vol. 6. p. 270

‡ Willough. *Ichthyol.* p. 106.

§ *Brit. Zool.* ubi supra. *Vide etiam* Willough.

cient *Romans*, we do not hear so many fanciful encomiums on particular dishes, nor such enormous sums paid to procure them. Accordingly, the lamprey known among us, has obtained no very extraordinary character. It is differently estimated, according to the season it was taken, or the place where it was fed. The best season for them is in the months of March, April and May; for they are more firm immediately after their arrival in the rivers from the salt water, than afterwards. Towards the Summer, and in the hot weather, after they have deposited their spawn, they are observed to be much wasted; and their fish becomes flabby, and bad eating *. Those caught in several of the rivers in *Ireland*, the people will not venture to touch †; and throughout the whole of *Scotland* they are held in detestation: while those taken by the *English* in the *Severn*, are considered by them as the most delicate of all fish whatever. Prejudices, though of opposite kinds, seem to operate in each of these cases, whether in producing disgust or predilection.

At a very early period, we find, the lamprey was reckoned a great delicacy by the *English*: That they are a heavy surfeiting food, the experience of one of their monarchs fatally testified; for the death of *Henry I.* was occasioned by eating too plentiful a meal of these fishes ‡. Notwithstanding this accident, they seem to have continued in high esteem, because we find *Henry IV.* granting protection to such ships as brought over lampreys for the table of his royal consort; and his successor issuing out a warrant to *William of Nantes*, for supplying him and his army with these fishes, wherever they might happen to march §.

In

* British Zoology.

† Goldsmith's Nat. Hist.

‡ Vide Hume's Hist. of England.

§ Rymer ix. 544. apud Pennant.

In proof of the ancient predilection of the *English* for this fish, it is a custom, from time immemorial, for the city of *Gloucester* to present annually his majesty with a lamprey pye, covered with a large raised crust. As the gift is made at Christmas, it is with great difficulty the corporation can procure any fresh lampreys at that early season, though they offer a sum far exceeding their usual price *. The various methods of taking the lampreys, it is not the business of this work to describe.

The fishes of this genus, from some peculiarity in their conformation, generally swim with their body on a level with the surface of the water; and, it is said, can easily be suffocated, by being immersed in it for any considerable time. From this circumstance, it is probable that they require a constant supply of air for breathing, and that they are possessed of lungs, though no naturalist has observed them in giving an account of the viscera of these animals.

Among this tribe, copulation is performed *ventrius commissis*, contrary to the manner of the greater number of fishes: When engaged in the business of procreation, they generally frequent the shallow water, where their habits admit of being easily examined. The female, when ready to spawn, digs a hole in the mud, where she deposits her ova; and in this operation, the power of suction, which we have already described, is of singular advantage; for, should she meet with a stone, though of considerable bulk, she raises and carries it out of the way †. After the ova are excluded, and buried in the excavation thus formed, the parent remains in the neighbourhood.

* British Zool. class iv. gen. iv.

† Balnerus apud Willough.

neighbourhood till the young are quickened into life. She is then seen, with her numerous family playing around her ; which, as soon as they have acquired sufficient strength, she gradually conducts to the sea.

The River Lamprey *.

THIS species is smaller than the former, seldom exceeding ten inches in length ; and is distinguished by transverse lines of a blackish colour †. The mouth is of the same round form as in the preceding fish, and is possessed of the same adhesive power. On the upper part of it, is a large bifurcated tooth ; on each side there are three rows of very minute ones ; and on the lower part there are seven, the exterior of which on each side is the largest ‡.

Like all the other fishes of this genus, there is between the eyes a spout-hole or orifice, resembling that of the cetaceous fishes, and probably destined for a similar purpose, that of ejecting water from the throat and lungs. The back fin of the river lamprey is not continued uninterrupted to the tail, but is broken off ; and behind it there rises a second, which goes round the tail, terminating at the anus.

This species, as well as the larger kind, is also eaten, potted and highly seasoned : By some it is preferred to the sea lamprey, being milder tasted. All these fishes
are

* *Lampetra medium* genus, Will. La lamproye d'eau douce, Belon. *Petromyzon fluveatilis*, Lin. Syst.

† Willough, page 106.

‡ British Zool. class iv. gen. iv.

are probably heavy and unwholesome, more highly recommended by the epicure than the physician*. They are taken in such vast numbers in the *Thames*, the *Severn*, and the *Dee*, that they constitute a considerable branch of trade. They are sold to the *Dutch*, who use them for bait in the cod fishery : besides what are consumed in *England*, 450,000 have been exported in a season for this purpose, at two pounds per thousand.

The Pride†.

THIS species is exceedingly small, being from four to eight inches. It is a British fish, but found also in the rivers of *Germany* and *Italy*. In the river *Ils*, and other streams near *Oxford*, they are abundant, where, instead of concealing themselves, they roll in the mud, and never are observed to adhere to the stones, like the other lampreys‡.

The back is of a livid colour, approaching to black ; the belly silvery, and more resplendent, than the larger kinds. The mouth is of an elliptical shape ; within it are six or seven teeth, and above them a small semicircular bone. Upon the top of the head is a small tube, or aperture, like the cetaceous fish : The belly swells and contracts alternately, as in those animals which breathe by means of lungs. It has two dorsal fins ; the first rising about the middle, and supported by small tendons, that

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are

* Willough. ubi supra.

† Laperon, or pride of the *Ils*. Will. *Petromyzon Branchialis*, Lin. *Syst.*

‡ British Zoology.

are scarcely visible : The other takes its rise immediately behind it, surrounds the tail, and terminates in the middle space, between the tail and the anus *.

Willoughby describes two other species of the lamprey ; the *mucu* peculiar to the marshes and lakes of *Brazil* ; and the blind lamprey, a small round fish, no larger than May worms : The last marked round the body with 84 transverse lines, or annuli, resembling those upon the terrestrial worm †.

* Willough. page 105.

† *Vide* Ichtyol. loco citato.

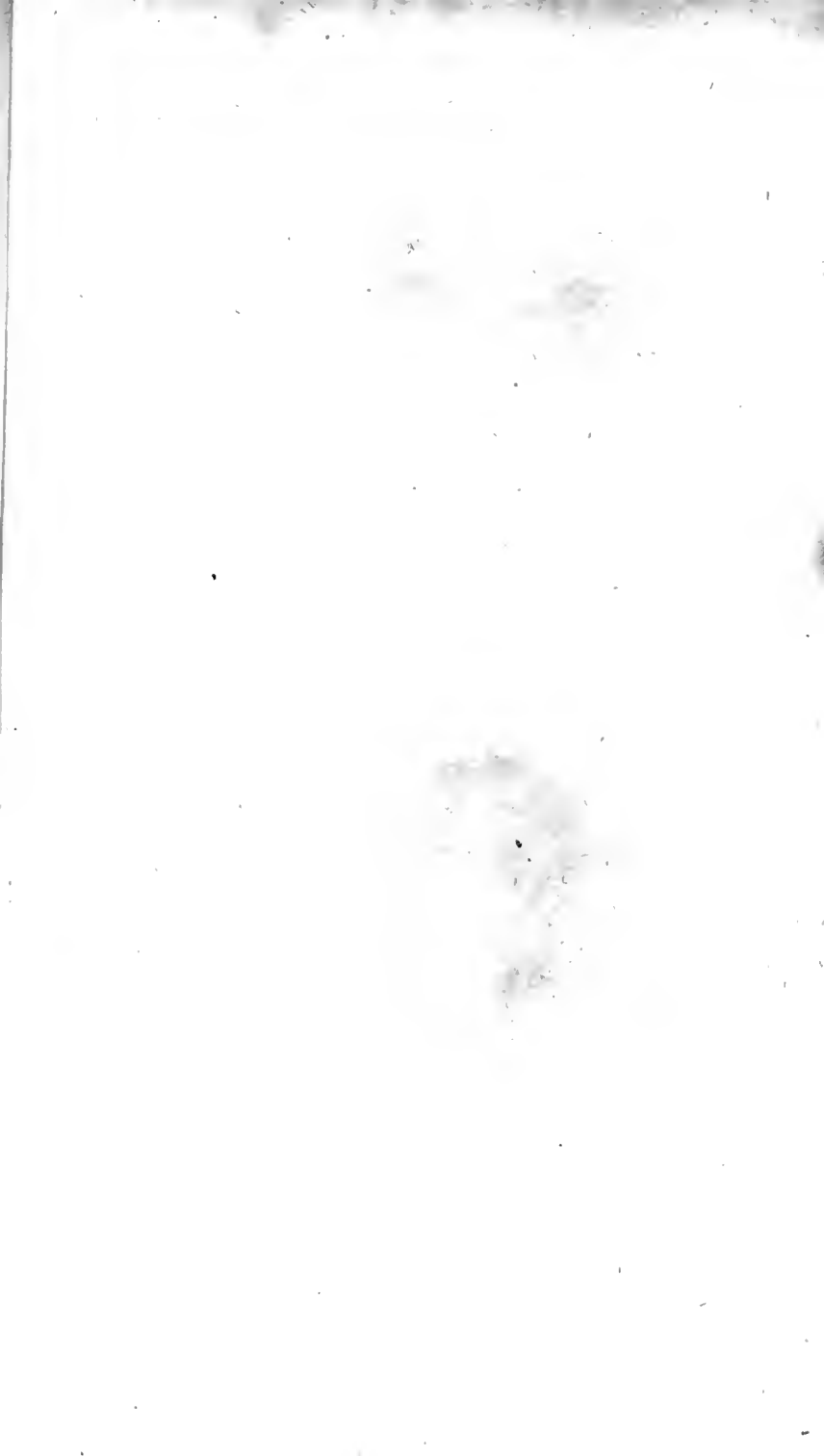
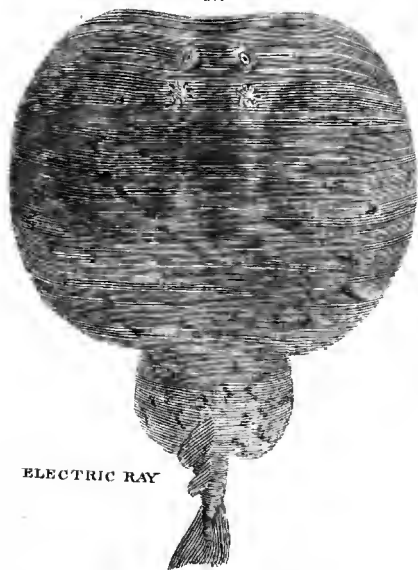
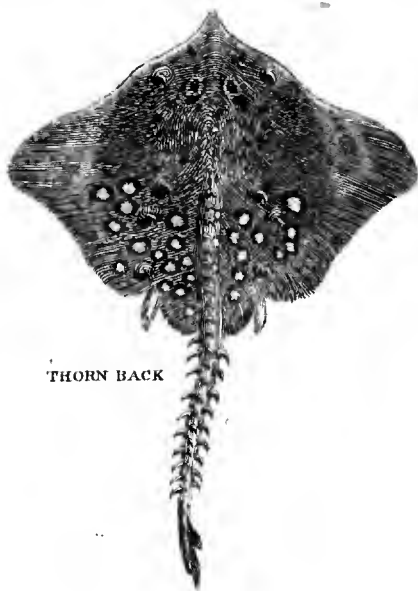


Plate IV.



ELECTRIC RAY



THORN BACK

SECTION III.

GEN. VI. *The Ray.*

THIS genus is easily distinguished from all other kinds of fish, by a broad, flat, and thin conformation. The five branchial apertures on each side, are placed under the animal; they want the bony opercula, and are marked by the same peculiarities, that distinguish the other cartilaginous tribes. The mouth, in all the fishes of this genus, is situated quite below the head; while the body of the greater number is beset with spines or prickles, resembling those on the branch of a thorn, a circumstance from which they obtained their ancient name*; that of *ray*, which we now apply to the genus, is derived from the latin.

This genus comprehends all the rays, thornbacks, and flairs, or skates, which are distinguished by manners as singular as their external form. *Willoughby* has described fourteen different species, and *Linnaeus* nine; of which no less than eight frequent the *British* coasts †.

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With

* *Bæros*, which signifies the berry that grows upon a prickly stem, *Vide* Gesner.

† *Système Nat.* and *British Zoon*.

With regard to their dietical uses, these fishes are very different; some of them affording a plentiful supply of salubrious food, while others are noxious and terrible; with respect, however, to their nature, appetites and conformation, the similitude among them is perfect and entire.

Of all the larger fish, the rays are the most numerous; and their numbers are in a great measure owing to their size, and to the protection of those frightful spines which nature has afforded them. There is none of the rapacious tribes, except, perhaps, the cachalot and white shark, that has a swallow sufficiently large to receive them; and even these are, probably, often deterred from their purposes of destruction by the armour with which their prey is covered *. Of some the size is such as to defy all the powers of destruction which even the shark himself is known to possess: In *England* some have been taken upwards of two hundred pounds weight; but that is far inferior to their enormous bulk in other parts of the world. Near the island of *Guadaloupe* in the *West Indies*, a ray was killed, thirteen feet eight inches in breadth, and twenty-five from the snout to the tip of the tail. This member itself contributed largely to this prodigious dimension; for it was twenty inches broad at its insertion, and tapered to a point, by which it terminated fifteen feet behind the body of the animal †.

The fishes of this genus probably attain to a much larger size, than that of any individual that has ever yet been examined: It is only the smallest of the kind that approach the shores; the larger continue forever prowling

* Goldsmith's Nat. Hist.

† Labat,

at the bottom, in the unfathomable caverns of the ocean, where they probably continue growing for ages. The utmost bulk of the ray cannot therefore be ascertained; but it has been supposed; that they are the largest inhabitants of the sea *. When, however, they surpass the size commonly observed by the fishermen, they become totally unfit for food; the negroes, and starved savages of *America*, indeed, cut them up, even of the largest size; and the tenderer parts, when salted, are reckoned among their delicious morsels.

These fish generate in March and April; at which time they swim near the surface of the water, several of the males pursuing one female: With such avidity of desire do they engage in the work of procreation, that the fishermen frequently draw up both male and female still adhering together, though only one has taken the bait †. The females are prolific to an extreme degree, there having been no less than three hundred eggs taken out of the body of a single ray. These eggs, containing the foetus, acquire a tough horny covering after descending into the womb; for while they continue in the *ovarium*, they are attached to it, like the small eggs in the body of a hen; after they drop into the womb, the formation of the animal becomes visible, and the shell is formed by the concretion of the fluids of that organ; when come to their proper maturity, the young are excluded, but never above one or two at a time, and at the interval of three or four hours. The females begin to cast their purses, as the fishers term it, in the month of May, and continue producing young till September. In October, when
their

* Goldsmith's Nat. Hist.

† British Zool.

their parturition ceases, they are exceedingly poor, and then they improve gradually during the winter and spring, till May, when they are at their highest perfection, and when they again begin to undergo the same functions *.

The rays generally frequent those parts of the sea where the bottom is black and muddy, where their voracity leads them indiscriminately to devour every living animal which they can surprise: But although their appetite is ravenous and indiscriminate, they become more delicate with regard to a baited hook; they devour below any putrid substance whatever, but if the bait has been taken up and suffered to lie for any time in the open air, they will not touch it: they appear by their manner to perceive the line, and to dread it; but the impulse of their hunger is too great for their caution, and, even though they perceive the danger, if thoroughly hungry, they devour, as if regardless of destruction †.

Both *English* and *Dutch* carry on the fishing to a considerable extent; the season at which they begin is early in the winter; and the boats in which the fishermen put to sea, are of different sizes, according to the distance of the place where they intend to fish. The vessels used in the *British* Channel, called cibles, are of one ton burden, rowed with three pair of oars, and admirably constructed for encountering a mountain sea. When they go out to fish, every person is provided with three lines; each man's lines are fairly coiled upon a flat oblong piece of wickerwork, the hooks being baited, and placed very regularly in the centre of the coil. Each line is furnished with
two

* Brit. Zool.

† Goldsmith's Nat. Hist.

two hundred and eighty hooks, at the distance of six feet two inches from each other; the hooks are fastened to lines of twisted horse hair, twenty-seven inches in length.

When fishing, there are always three men in each coble, and consequently nine of these lines are fastened together, and used as one line, extending in length near three miles, and furnished with above two thousand five hundred hooks; an anchor and buoy are fixed at the first end of the line, and one more at the end of each man's lines; in all, four anchors, and four buoys made of leather or cork.

The line is always laid across the currents; the tides of flood and ebb continue an equal time upon our coast; and, where undisturbed by winds, run each way about six hours; they are so rapid, that the fishermen can only shoot and haul their lines at the turn of the tide; and, therefore, the lines always remain upon the ground six hours; the same rapidity of tide prevents them from using hand lines, and, therefore, two of the people commonly wrap themselves up in the sail, and sleep, while the other keeps a strict look out, for fear of being run down by ships, and to observe the weather; for storms often rise so suddenly, that it is sometimes with extreme difficulty they escape to the shore, though they leave the lines behind them.

Such is the account which M. Pennant gives * of the manner in which the taking of these fish is conducted in the channel; but there are annually larger vessels, of twenty-five tons burden, that repair at the time of Lent to the *Dogger Bank*, where they fish for turbot, cod, ling, and

* British Zoology.

and skates ; there the business is carried on in a more expeditious manner, for as the fishers have no occasion to wait the returns of the tide, each man takes along with him twice the number of lines, which he continues to bait, haul, and shoot, without interruption.

But this method of fishing, operose as it may seem, and this extent of line, though it runs three miles along the bottom, is trifling when compared to the exertions made in the *Mediterranean* by the *Italian* fishers ; there they go to sea in a *Turtan*, a vessel much larger than ours ; and they bait a line of no less than twenty miles long, with above ten thousand hooks. This line is called the *parisina* ; and the fishing goes by the name of *pielago* *. A piece of tackle of such enormous length, it is impossible to haul and shoot in the same space with the *English* lines : it remains for a considerable space in the sea, and cannot be taken up in less than twenty-four hours. By this apparatus, they not only take rays, but sharks and other fish ; some of which are above a thousand pound weight. When a fish of this magnitude is found at the line, the fishermen are provided with an harpoon to dispatch them before they are brought on board.

* *Vide* Goldsmith.

SECTION IV.

The Skate *.

THE skate is the largest of this genus, and thinnest in proportion to its bulk: In these colder latitudes it is seldom found above two hundred pounds weight. *Willoughby* mentions one sold in the market of *Cambridge*, which, when dressed by the cook of *St. John's* college, dined an hundred and twenty students †.

The nose, though not long, is sharp pointed; above the eyes there rises a set of short spines: The whole upper part of the body is a pale brown, resembling the wet sand with which the animal is said to cover itself. The body, towards the sides, is thinned down into two fins, that have the appearance of wings; and at the buttocks there are others of a thick fleshy substance. The tail of this species is short, obtuse, of a roundish form, but compressed a little towards the sides ‡.

The lower part of the body is white, plentifully marked with a great number of minute black spots, which are supposed to be the glands, by which that slimy mucus which covers the fish is secreted. All fish covered with a similar glutinous matter, are observed to possess the same organs of secretion §. The skull of the skate

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is

* *Raia Batis*, Lix. Syst. The Skate or Flaire, Will.

† *Vide* Ichthyol. page 71.

‡ *Idem* ibidem.

§ *Nicolas Steno* apud *Willoughby*.

is filled with a copious collection of clear glutinous matter, through which all the nerves that are distributed to the different parts of the body, appear transparent. Among these are seen the optic and olfactory nerves; the latter proceed through the apertures, all along to the nose, and afford full proof that this animal possesses the sense of smelling.

*The Sharp Nosed Skate *.*

WILLOUGHBY describes a fish of this species, which he examined at *Rome* in 1664: They are frequently taken on the *British* coasts; and are distinguished from the former by their long, narrow, and sharp pointed nose, not unlike the end of a spoutoon †. The mouth is very large, and furnished with a number of small sharp teeth, bending inwards: The tail is thick, and terminates in two small fins.

This is supposed to be the *bos* of the ancient naturalists, a fish they describe as of an enormous size ‡. *Oppian* gives an account of its fondness for human flesh, and the method it takes of destroying men, by overlaying them, and keeping them down with its vast weight, till they are drowned. Other writers give the same relation, and confirm the character of these *anthropophagi* §. In the south they are so well known, that the persons employed

* *Raia oxyrinchus*, Lin. Syst. Idem, Willoughby.

† Pennant's Brit. Zool.

‡ *Euphialos πάλιστον μέγιστον*. Halcut.

§ *Vide* Philé de propriet. anim. et Ulloa's voy. i. 132.

employed in the pearl fishing; have learned from the fatal experience of many of their own number, how much they ought to be guarded against. These unhappy divers, are sometimes surrounded, and wrapped up by the fins of the manta, for so this animal is there called, till they are suffocated: The negroes, therefore, take care never to go down without a sharp knife to defend themselves against this terrible enemy.

The Torpedo, or Electric Ray *.

THIS species inhabits our seas, where it grows to a large size, some weighing no less than eighty pounds; its colour is a dirty clay; the head and body are round, and but indistinctly separated; the latter extremely thin, and attenuated towards the edges. Behind the eyes are two wide foramina, which *Willoughby* supposes; are intended for conveying sound†: they are beset with six cutaneous rags on their inner circumference, and communicate with the mouth.

The torpedo can live only twenty-four hours out of the sea, and but little longer if put into fresh water; it inhabits those places where the bottom is sandy, and buries itself superficially in it, by flinging the sand over upon its back with a vibration it gives its extremities.

O 2

It

* *Raja Torpedo*, Lin. Syst. Cramp-fish, Will.

† *Ichthyol.* page 81.

It is in this concealed situation that the torpedo astonishes the unwary passenger, who inadvertently treads upon it, by the exertion of a power perhaps the most extraordinary and mysterious in nature.

The narcotic power of this animal has been taken notice of in all ages *; it is so powerful, that when the fish is alive, the instant it is touched, it benumbs the arm, and sometimes the whole body †. The same effect is produced, even when it is touched with a stick, or tread upon by a person who has his shoes on. *Oppian* stretches the matter probably too far, when he alleges that it will benumb the fisherman through the whole length of the line and the rod ‡.

The shock given by this animal, most nearly resembles the shock of an electrical machine, sudden, tingling, and painful: It is thus described by *Kempfer*; "The instant," says he, "I touched it with my hand, I felt a terrible numbness in my arm, as far up as the shoulder. Those who touch it with the foot, are seized with a stronger palpitation, than those who apply to it the hand. This numbness bears no resemblance to that which we feel when the vein has been a long time pressed, and the foot is said to be asleep; it rather appears like a sudden vapour, which, passing through the pores in an instant, penetrates into the very spring of life, from whence it diffuses itself over the whole body, and gives real pain; the nerves are so affected, that the person struck, imagines all the bones of his body, and particularly those of the limb that received the blow, are driven out of joint; all
this

* Vide *Galen*, *Alian* and *Gillius*.

† *British Zoology*,

‡ *Halcut*.

this is accompanied with an universal tremor, a sickness off the stomach, a general convulsion, and a total suspension of the faculties of the mind: In short, such is the pain, that all the force of our promises and authority, could not prevail upon a seaman to undergo the shock a second time *."

The substance which the torpedo discharges, and which produces effects so violent and instantaneous upon the human frame, is probably electric matter, but by what means the animal so soon collects it, no naturalist has been able to explain. Great as its powers are when the animal is in vigor, they are impaired as it declines in strength, and totally cease when it expires †; they impart no noxious qualities to the fish, when used as food; for the *French*, who find it in plenty on their coasts, very commonly dress and eat it ‡. *Galen*, we are told, recommends it in epileptic complaints, while *Rondeletius* and *Willoughby*, decidedly condemn it in all cases, as a watery, soft, and fungous aliment §.

The narcotic power of the torpedo, however it may affect it as food, is serviceable to the animal in two important respects; both as a means of defence against voracious fish, and a method of procuring subsistence from among the smaller tribes; the former, when electrified, are deprived of all possibility of seizing their prey; and the latter, after having unwarily approached the torpedo, and received the shock, are incapable of making their escape ||.

The food of the torpedo is surmulletts and plaise; the former is so swift, that it is impossible for the torpedo to take

* Kempfer's travels.

† Salvianus and Willoughby. p. 82.

‡ British Zool.

§ Rondel de piscib. and Willough. Ichthy. l. p. 82.

|| Plinii Hist. Nat.

take it by pursuit: and as this fish has been found in its stomach, it justifies *Pliny's* account of the manner in which this animal secures its prey. The torpedo is taken at *Torbay*, off *Pembroke*, and at *Waterford* in *Ireland*; it is caught with the other flat fish, with the trawl, and is commonly found in water forty fathom deep, in company with the congenerous rays *.

Those animals are said to bring forth their young about the time of the autumnal equinox †; but from a dissection of one made by a French gentleman, they seem capable of superfoetation, and of consequence must produce young at different times. *Rondeletius* ‡ mentions two species of the torpedo, and *Willoughby* describes an *American* kind after *Margrave*, of a foot and nine inches in length, and seven in breadth. It is without teeth, and has two spiracula below the neck §.

The Fire-flare, or Sting ||:

WERE we to credit all the marvellous accounts which the ancient naturalists have given, of the venom lodged in the armour of this fish, we would unavoidably dread it, as an animal still more formidable than the torpedo ¶. The weapon in which nature is said to have lodged this
poison,

* British Zool.

† Aristot. Hist. animal.

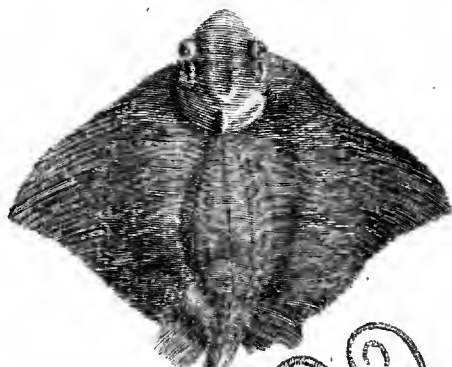
‡ De piscibus.

§ Vide Ichthyol. p. 80.

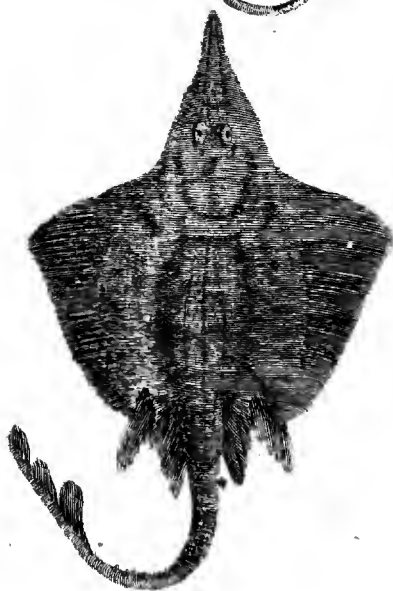
|| *Pastinaca marina lævis*, Will. La Pastenade de mer. Belon.

¶ Pliny, Ellian, and Opiam.

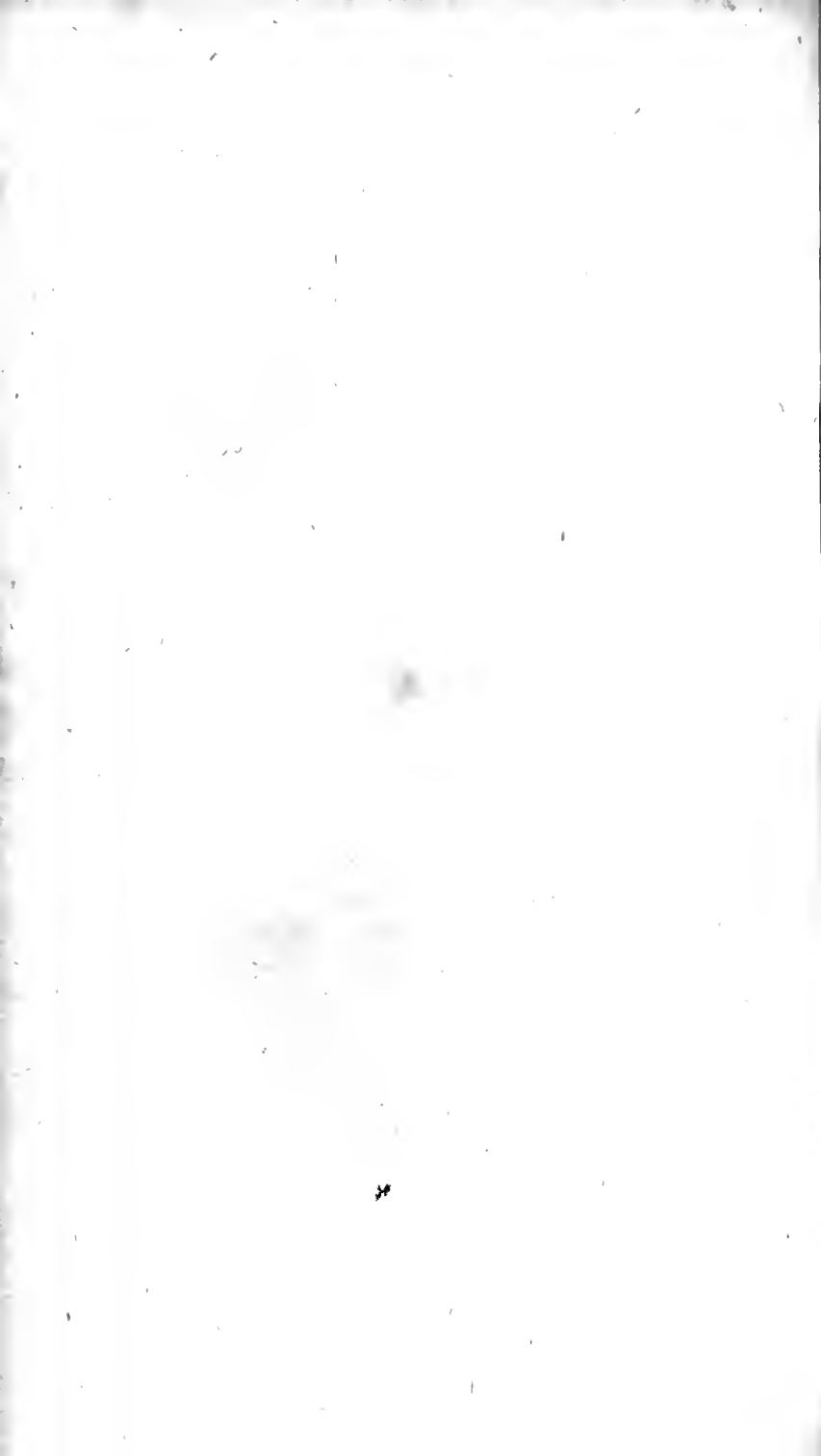
Plate V.



STING RAY



LONG NOSED RAY



poison, grows like a spine from the tail ; it is about five inches long, and about four inches behind the body. According to the tremendous fables of *Pliny*, it is furnished with a venom so potent, as to affect even the animal creation. Trees that are struck with it, instantly lose their verdure, and rocks themselves are incapable of resisting this powerful *virus* *. It was with the spine of the trygon, or fire-flare, that the enchantress *Circe* armed her son ; and with this irresistible weapon, he, unintentionally, became the murderer of his father *Ulysses*. What a happiness it is that these animals do not frequent the woods, and are so seldom seen ashore !

Succeeding naturalists finding the taste for the marvelous had decreased in their age, have been obliged to give the history of this fish a greater degree of verisimilitude ; curtailing it of its powers against inanimate nature, they have contented themselves with making it formidable to the fishermen †. Their opinion has been sanctioned by the name of Linnaeus, who ascribes poisonous qualities to no less than three different fishes ; the fire-flare, the torpedo, and the tetrodon lineatus ‡. It may be justly doubted, however, whether any fish has a spine charged with actual poison ; as far as the *sting* is concerned, we know that this is not the case : The spine is its peculiar weapon of offence, and is capable of giving a very bad wound, which being commonly inflicted on the tendonous parts of the body, and by those who are constantly working in cold water, is sometimes painful, and difficult to cure §.

But

* *Historia animal.*

† Vide Gesner, Aldrovandus and Rondeletius.

‡ *Syst. Naturæ.*

§ *Brit. Zool.*

But the spine of the fire-flare, though unattended with any poisonous qualities, is still a formidable weapon.—There is reason to believe, that in early times, before the use of iron, the spears and darts were headed with this bone, instead of that metal. The arrow of many of the South *American* tribes, are still pointed with the bones of this fish; and from its hardness and sharpness, it makes no contemptible weapon*.

The fire-flare, formidable as it has been deemed, is never rejected by the fishermen when found in his tackle; he commonly cuts away the tail, and exposes it for sale, deprived of this instrument of mischief. This species never grows to the size of those above described; the most common sized weigh about eight or ten pounds, and are about two or three feet from the snout to the end of the tail†; the nose is very sharp at the point, but short; the mouth is small, and provided with granulated teeth; the eyes are protuberant; the irides of an oblong shape, and of the colour of gold. The whole body of the animal is smooth, flat below, but rounded above, and more elevated in the middle than any of the other rays‡.

The fire-flare casts its spine, and renews it annually; and that it may at no time be without a proper instrument of defence, it is sometimes seen with the new one growing up, before the old drop off. That nothing relating to this animal might be divested of the marvellous, its fish was said to have the peculiar quality of exciting concupiscence; and when used in a decoction of oil, it was reckoned a cure for the leprosy: The point of its spine, when introduced into a diseased tooth, made it splinter and drop from the jaw||.

* Robertson's Hist. of South America.

† Will. p. 67.

‡ Brit. Zool.

|| Vide Gesner.

The Thornback *.

THE thornback is the last of this genus which we shall particularise; and its figure is so well known, that a short description will suffice. It is of a rhomboidal shape, broader, however, than long, and distinguished from all the other species of the ray, by three rows of spines upon the back, and five upon the tail, all pointing towards its end. The mouth is small, and fitted with granulated teeth; between the nose and the eyes are a few spines; others are scattered without any order upon the pectoral fins.

The colour of the upper part of the body is that of pale ashes, marked with streaks of black, and the skin rough, with small tubercles like shagreen. The belly is white, crossed with a strong semilunar cartilage †. *Willoughby* has given a long detail of the internal structure of this species; by which it appears, that it has two distinct organs, of a curious conformation, one on each side, for generating and excluding its eggs: In these are deposited innumerable ova of various sizes ‡; hence, the thornback must be very prolific. It begins to generate in the month of June, and continues production till September; its young, as long they are incapable of breeding, are called maids; they are good eating at all times of the year, but the old only begin to be in season in the month of November.

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The

* *Raja clavata*. Lin. Syst. Idem Rondeletii et Will.

† British Zool.

‡ Ichthyol. p. 76.

The fishes of this species are found in great plenty, and make a considerable article in our fish markets. They are fond of devouring herring, mackrel, and eels; but their common food is probably the different kinds of ground fish; crustaceous animals, such as the crab and lobster, have been found in their stomachs, which are supplied with a powerful solvent, capable of speedily reducing the shells into a chyle fit for their support.

SECTION V.

GEN. VII. *The Shark.*

THE fishes of this genus are the most formidable and voracious of all the tyrants of the ocean; if some of the rays were invested by the credulity of the ancients, with imaginary powers of destruction, those possessed by the shark are real. The spine of the fire-flare might often prove hurtful, but the fangs of the shark are always fatal. The genus is distinguished by an enormous mouth, placed beneath the head, armed both above and below, with an hundred and forty-four frightful teeth, which the animal has the power to raise or depress at pleasure; to this hideous apparatus of destruction, the shark joins a fierceness and rapidity, far superior to that of the other rapacious tribes: The smallest of the race is dreaded by almost every fish in the sea; for there is hardly any of them that dread an encounter with animals far superior in size, and more formidable in appearance. The white shark, which is the largest of this tremendous race, maintains a terrible despotism in the ocean; for, with that amazing velocity peculiar to his tribe, he unites the strongest appetite for depredation. He approaches nearly to the size of the whale, but far surpasses that animal

in strength and celerity, in the formidable arrangement of his teeth, and in his insatiable desire of plunder *.

The head and throat of the shark are larger than the proportion to the body, which is slender and tapered away almost to a point as it approaches the tail. The teeth are broad at the base, but slender and very sharp above; they are disposed in five rows all around each jaw, and at their insertion are furnished with strong muscles, by means of which the animal raises or depresses them; when the shark is at rest, they all lie flat in his mouth; but when he comes forward to lay hold of his prey, these dreadful instruments are suddenly raised, and the devoted animal, seized by them, instantly dies, pierced with an hundred wounds.

The animals of this genus have a wild and ferocious aspect, that faithfully indicates the malignity of their nature: Their eyes are oblong, sunk in the sockets, and placed longitudinally in the head, where they appear almost overhung by the skin, and are full of malevolence and fire: The fins, to which they owe their rapidity of motion, are larger, and more numerous than those of most other fishes: The body, though slender, is possessed of very strong muscles, the source of that astonishing impulse communicated by the tail. The whole external parts are covered with a rough and hard skin, which was used by the ancients in polishing wood and ivory; but is now applied to cover instrument cases, the skin of the greater dog fish furnishing a preferable shagreen †.

The

* Goldsmith's Nat. Hist. vol. vi. 238.

† British Zoology, Class iv. gen. 6.

The shark thus fitted by his external conformation for rapin and bloodshed, is endowed also by nature with a courage and activity that gives effect to his rapacious instincts. No fish, it is said, can swim as fast as he; none is so constantly employed in swimming; scarcely a ship crosses the *Atlantic*, that is not attended by some of these rapacious monsters, for days together; and such is their velocity, that they outstrip the best sailing vessel, and play around her without any symptoms of exertion. With such voracious appetites, and such powers of gratifying them, one would imagine that these animals might have long since destroyed the inferior tribes, and thinned even the ocean itself of its inhabitants; but happily for the safety of the smaller fishes, these plunderers, by the particular situation of their mouths, are obliged to turn upon their side before they can seize their food; and while this evolution is performing, their prey often finds time to escape*.

But although the devastations committed by the shark, are thus providentially limited by the awkward situation of his mouth, still his depredations are extensive, and in every warm climate he is the terror of the sailors; for of all kinds of food, he is said to discover the strongest predilection for human flesh. If by any accident a seaman has fallen a victim to this destroyer, he is seen for some time afterwards hovering about the same place, and making several returns to the spot, expecting another repast of the same booty: The wake of a ship is a favourite resort with those animals, and numberless are the instances in which accident, or the improvident rashness of seamen, have

* Goldsmith.

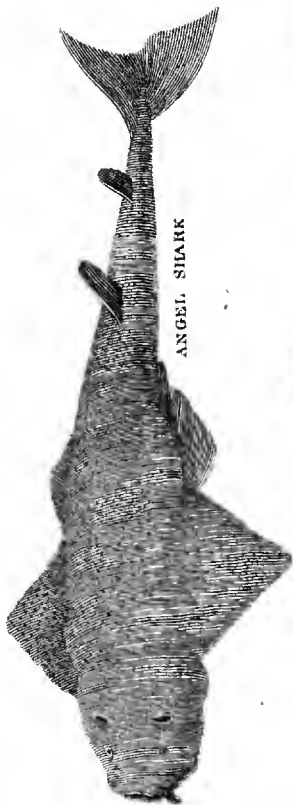
have favoured their designs upon the human race. Along the coast of *Africa*, where the sharks are numerous, many of the negroes, it is said, who are obliged to fish for their sustenance, are annually devoured by them. The inhabitants of these dreary regions are firmly of opinion, that the shark prefers the flesh of a black man to that of a white; and that in consequence of this unenviable distinction, if two persons of different colours are both in the water together, his choice falls always upon the negro*.

Whether there be any foundation for this opinion of the negroes, it is of little importance to inquire; that the shark discovers an avidity for this species of food, is a fact that has been too often verified by fatal experience, to admit of a doubt. Mr. *Pennant* relates the story of the master of a *Guinea* ship, who, finding a rage for suicide prevail among his slaves, from a notion the unhappy creatures entertained, that after death they would be restored to their families, their friends, and their country; to convince them, that at least some disgrace should attend them here, ordered one of their dead bodies to be tied by the heels to a rope, and so let down into the sea: Though it was drawn up again with great swiftness, yet in that short space the sharks had bit off all but the feet†. *Goldsmith* tells another, occasioned by the same barbarous traffic, of a woman who was thrown out alive, to deter the slaves from self murder: When the rope was drawn to pull her up into the vessel, part of her body appeared in circumstances too shocking to be mentioned.

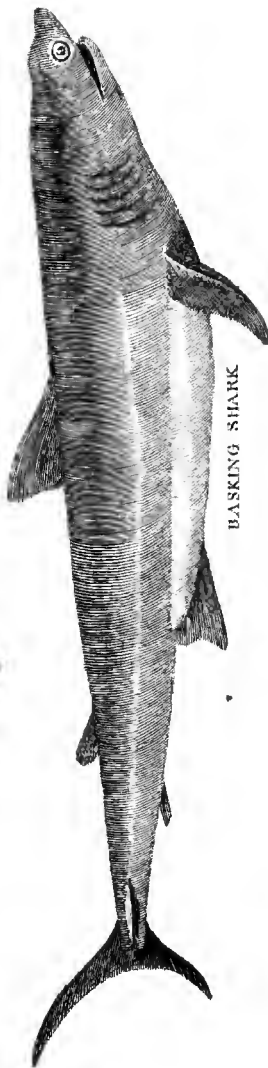
* Idem ibidem.

† British Zoology.

Plate VI.



ANGEL SHARK



BASKING SHARK

SECTION VII.

The Angel.*

THIS fish possesses the character of extreme voracity, common to the sharks and rays, two genera which nature seems to have intended this animal should, in some measure, connect together: In its external figure, it partakes of the nature of both, while it differs from each in the situation of the mouth; that organ being placed in the extremity of the snout, and not below the head †.

The angel grows frequently to the weight of an hundred and sixty pounds: Its body is covered over with a filthy mucus, beneath which lies a rough skin, employed formerly by the workmen as a shagreen ‡. It was from this circumstance, that the fish obtained the name of *file* among the *Greeks* §; while the *Romans* called it *Squatina*, from the filth with which the body is covered ||. The colour of the back and sides is brownish, that of the belly white. The pectoral fins are large, and seem, like those of the rays, to be a prolongation of the body: It was from these wing-like fins that this fish received its *English* name ¶.

The

* *Squalus Squatina*, Lin. Syst. L'Ange, ou Angelot de Mer, Belon.

† Brit. Zool.

‡ Plinii. Lib. ix. Cap. 12.

§ Pwn, Arist. Hist. Anim.

|| *Squatina*, Vide Willough. page 80.

¶ Idem ibidem,

The ventral fins are placed in the same manner as the pectoral, and to them is annexed on each side the double penis, that characterises this and the former genus. Upon the back, and farther down than the anus, there are two dorsal fins: The tail is bifurcated, the upper lobe rather larger than the under; a character belonging to all the sharks.

This species is described by *Rondeletius* as an inhabitant of the *Mediterranean*; it is also seen frequently on the *British* coasts, where it preys voraciously upon the flat fish that frequents the bottom of the water. The flesh is in no request, but seems loathed in every country, on account of its rank flavour and hardness: Its ova, when dried, are used for medicinal purposes, and are supposed by the *Italian* fishermen to be efficacious in removing a diarrhoea*. The *Turks* upon the *Barbary* coast, apply the skin in the manufacture of sheaths for swords, which they are said to fabricate with peculiar neatness†. None of the uses, however, in which the parts of this malignant monster are employed, seem capable of compensating the dangers to which seamen are continually exposed, from its voracious habits.

* *Rondeletius de piscibus.*

† *Jovius.*

The Basking Shark *.

THIS is the largest animal of this genus, and differs in some remarkable characters from the rest of the tribe; it inhabits chiefly the cold climates, and has long been known to the inhabitants of the west of *Scotland* and *Ireland*, where it is distinguished among the sailors by the name of the basking shark, though better known in the former country by the name of the Sail-fish.

The latter of these names has been given it, because it is seen at a distance on the top of the water, with all its dorsal fins appearing above the surface, and spread like sails. Both in its manners, and external form, there are peculiarities in which it differs from the other sharks. It is far from being either voracious or fierce: Its food consists chiefly of sea plants, no fish having been ever found in its bowels; but the green, and half digested remains of *algæ*: As its habits resemble those of the whale, *Linneus* supposes that it is supported by the same food, asserting that it devours only medusæ †.

Mr. *Pennant* has given a very accurate description of this species, and seems first to have discovered its affinity to the sharks, by pointing out the five transverse apertures of the gills on each side of the neck: formerly it had been considered as a kind of whale ‡. The oil arising from their capture, is now made an article of trade in

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the

* *Squalus Maximus*, Lin. Syst. Sun-fish, Smith's Hist. of Corker

† *Systema Nat.*

‡ *British Zool.* class iv. gen. vi.

the west of *Scotland*, where we have seen from six to eight barrels taken from one fish, though it is only the liver that produces it. They lie quiet and motionless on the surface, commonly on their bellies, but sometimes like tired swimmers, upon their back; and it is in this posture that they allow a boat to approach them, sometimes till it is within contact, without attempting to escape. Then the harpconer strikes his weapon into the body, as near as possible to the gills: But so insensible are they to the wound, that they do not feel its pain, till, by the united strength of two men, the instrument is forced very deep into their flesh. As soon as they feel themselves wounded, they fling up their tail, and dive to the bottom. Frequently in their agonies, they coil the rope about them, attempting to disengage the harpoon by rolling upon the ground.

Having at length discovered that all efforts of this kind are vain, they swim away with amazing rapidity, and with such violence, that a vessel of seventy tons has been towed after them against a fresh gale. They sometimes run off with two hundred fathoms of line, and with two harpoons in them; and will employ the fishers for twelve, and sometimes twenty-four hours before they are subdued. When killed, they are either hauled on shore, or, if at a distance from land, to the vessel side; where the liver is taken out and melted into oil, in kettles provided for that purpose*.

The basking shark is from fifteen to thirty feet in length; the colour above of a leaden colour, and below a pure white; the form of the body, like that of the shark kind, is slender and tapering. The upper jaw projects

* *Vide Pennant ubi supra.*

jects beyond the lower, and is rounded at the end; the mouth is placed beneath, and furnished with a vast number of small teeth. The dorsal fins are placed differently from those of the rest of the genus: the first rises nearer the head than the tail; the second is much smaller, and is situated near the extremity. On the under part of the body there are five fins; two pectoral, two ventral, placed below the second fin of the back, and a small anal fin. Near these the male animal is provided with a double organ of generation; and between them in the female, is situated the pudendum. The oil produced by these animals, is said to be preferable to every other for the manufacture of wool; and the skin furnishes workmen with an excellent shagreen.

The White Shark.*

1

THIS shark is probably the most ravenous and formidable of the order, and grows to the immense weight of four thousand pounds†. It was in the body of one of this species that an entire corpse was found; a circumstance no way incredible, when we consider their strong appetite for human flesh, and the amazing power of deglutition which an animal of this size must possess. In all hot climates, it is this species in particular that is the terror of the sailors; it is they that constantly attend the ships,

Q 2

watching

* *Squalus Carcharias*, Lin. Syst. *Lamia*, Plinij Hist. Nat.

† Gillius.

watching till some sailor drop overboard, or attempt to bathe; in either case, the unfortunate seaman perishes without redemption; for this voracious creature, will even dart up above the water to meet him in his fall.

It is in this fish that *Rondeletius* places the prophet *Jonas*, when he lay so long unhurt in bowels; and he says, that the language of Scripture gives no repugnance to his idea; for among the ancients all large fish whatever were termed whales*.

The mouth of this species is proportioned to the immense bulk of the animal: it is furnished with six rows of teeth, the number of which probably varies, according to the age of the fish. Fossil teeth of the white shark are frequently dug up in *Malta*, and sometimes in *England*: in the former country, they have been seen four inches long, which must have belonged to animals of vast size, if the proportions laid down by *Grew*, between the body and the teeth of this species, are just†: He asserts, that those in the jaw of a shark of two yards long, are not above half an inch; the fossil teeth found in *Malta* would, according to this calculation, belong to an animal sixteen yards in length. *Linnaeus* has enumerated fifteen different species of sharks; but if the appearances of the teeth, shewn in the collection of the curious, can be trusted to, he is far short of their actual number; for many kinds are seen, of which no mention is made by him.

Pliny, *Oppian*, and several of the ancient naturalists, were acquainted with this species, whose mouth they justly describe as situated far beneath the head, obliging the animal to turn almost upon its back, when it devours
its

* *Rondel. de piscib.* 489.

† *Rarities*, 91.

its prey *. The eyes are large, round, and staring, capable of being easily rolled in the sockets. The dorsal, and pectoral fins are very large, and aid the efforts of the tail, in giving rapidity to the fish's motion. The tail itself is semilunar, and capable of giving the most dreadful strokes; hence, the sailors, as soon as they take one of these fishes, so far disarm it, by cutting off the tail.

The Blue Shark †.

THIS species has obtained its name from the fine azure colour of the back; it is most frequently an inhabitant of the hot climates, where it is scarcely less formidable to seamen, than that immediately preceding. The body is less rough than those of the rest of the genus. The eyes are of an elliptical shape, but the irides perfectly round; behind them, there are none of those foramina, which are observed in other species ‡.

The fish is of an oblong shape; the nose long, sharp, and compressed towards the point; the nostrils are placed transversely. Although most frequent in the warm climates, the blue shark is often seen on the *British* coasts, and particularly those of *Cornwall*, during the pilchard season. It is there caught by the fishers, with a large kind of iron hooks, that are made for the purpose.

Rondeletius

* *Supina vescantur.* Plinii. Lib. ix. cap 24.

† *Squalus glaucus*, Lin. Syft. *Galeus glaucus*, Rondel.

‡ Willough. page 49.

Rondeletius ascribes to this species, only two rows of teeth; but their number probably depends upon the fishes age; and if so, no conclusion can be drawn with regard to it, from a single instance *: They are granulated, and of a triangular shape †. This naturalist declares, that he was an eye witness of the blue sharks fondness for human flesh; having seen one pursue a boy a considerable way along the shore, and making a spring at him, nearly bit of his legs.

It is concerning this species, that *Ælian* relates such extraordinary instances of parental affection ‡. It is said by him, that the blue shark permits its small brood, when in danger, to swim down its mouth, and take shelter in its belly. This fact is said to have been observed by *Rondeletius*, an able naturalist; and it is narrated by *Pennant*, a very accurate ichthyologist, as a part of the history of this whole genus that is entitled to belief. In fact, it is no more incredible, than that the young of the *opossum*, should seek an assylum in the ventral pouch of its parent; a fact too well known to be contested §.

* De Piscibus.

† Lin. Syst. Nat.

‡ *Ælii*. An. lib. i. cap. 16.

§ *Vide* British Zool. article, Blue Shark.

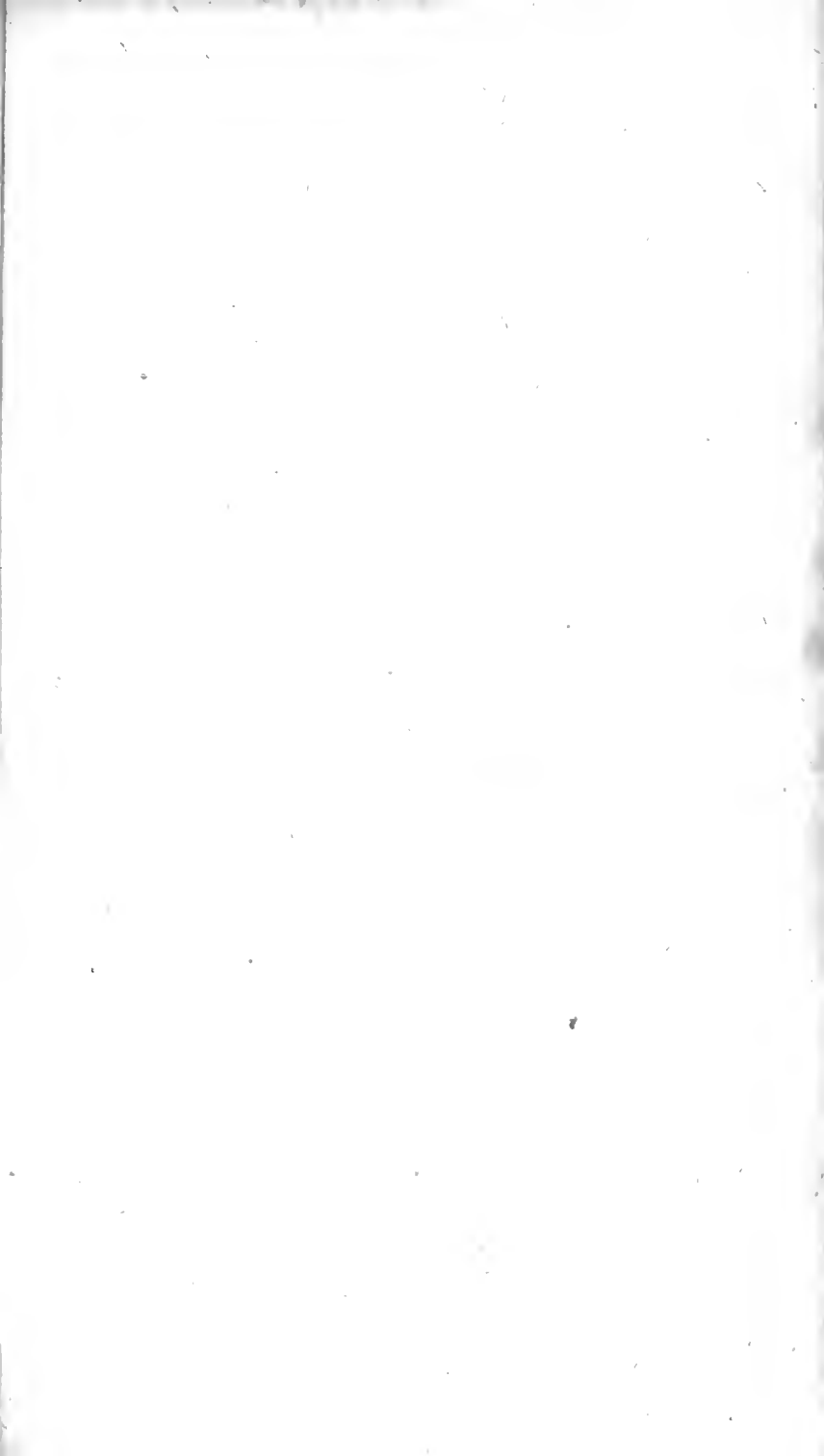
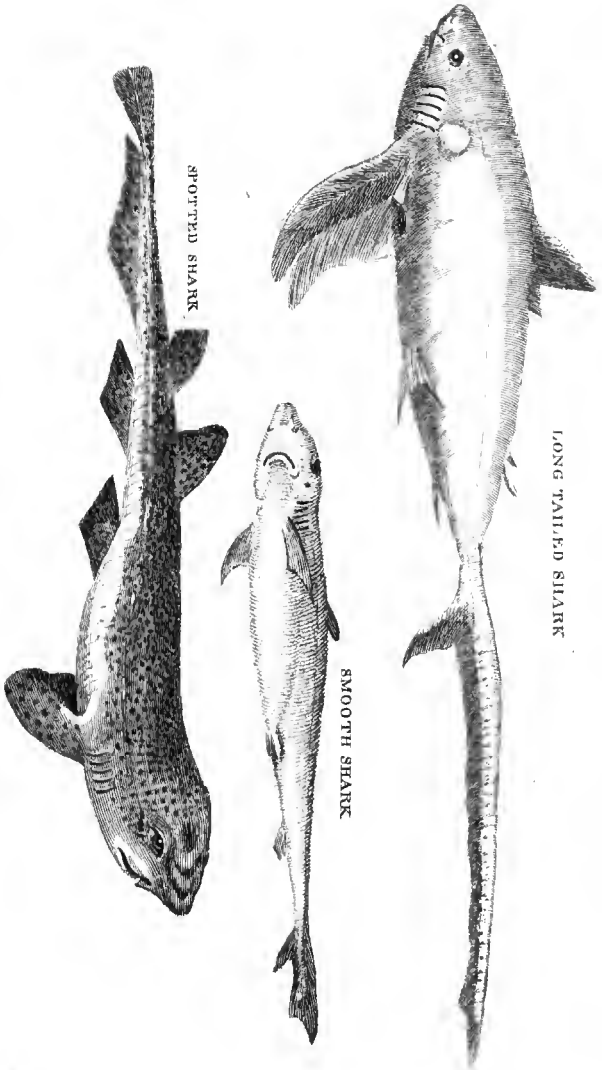


Plate VII.



The Long Tailed Shark, or Sea Ape *.

THIS species has obtained its name from the extraordinary length of its tail, which generally exceeds that of the body, the upper lobe extending greatly beyond the lower, almost in a straight line. Its fish has an abominable fetid, and rank smell, resembling that of the land fox †. The body is more thick and round than any of the sharks; the snout is sharp; and a little below is a small mouth, furnished with pointed teeth. The colour above is cinereous, below white. *Rondeletius* asserts, that he was an eye witness of this animal allowing its young to retreat into its belly to avoid danger; for he saw an old one dissected upon the shore, in the body of which were all its young. At first he imagined that they had been devoured by the parent in place of food; but upon examining them, they were all alive, and so entirely unhurt, that there could remain hardly any doubt of their having fled there as a refuge from danger ‡. The extraordinary length of the tails of the young, forms no objection to this fact; for at that age they are soft and pliant. *Willoughby* supposes that this fish was only found in the *Mediterranean*; it has since, however, been taken in the *British* seas §.

The

* *Vulpes Marina*, Rond. Sea-fox or Ape, *Willoughby*.

† *Salvianus*.

‡ *De Piscibus*.

§ *Pennant's British Zoology*.

The other fishes of this genus that frequent our coasts, are the *tope*, or sea dog of the ancient naturalists; the greater and lesser *spotted sharks*; the *smooth shark*; the *porbeagle*, and the *picked shark*: These all so nearly correspond in their general characters to those already described, that there seems no occasion farther to particularize them.

SECTION VI.

GENUS VIII. *The Angler.*

THE fishes of this genus were by the ancients called sea frogs *, from their resemblance to that animal: The *English* have given them a still more hideous name, that of sea toads, or sea devils; appellations which these animals seem to merit, by their extraordinary deformity. Of all the monsters contained in the ocean, they are perhaps the most ugly and deformed. Their head and body are joined together, forming one round flat mass †. The head and mouth are far larger than all the rest of the body; the latter being in some a yard wide, and furnished all around with an infinite number of small teeth. The pectoral fins are broad and thick; behind each ventral fin there is one aperture.

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* *Batrachos*, Aristot. Oppian. *Rana piscatrix*, Pliny and Ovid.† Willough. *Ichthyol.* page 83.

The Common Angler *.

IT is in its tadpole state that this animal resembles the frog: its colour upon the back is dark blue, marbled with some white spots. The lower jaw projects considerably beyond the upper, which gives the animal a grinning aspect. The eyes are placed in the upper superficies of the head, somewhat prominent, and their irides white. About half an inch from the corner of the upper jaw are two hairs, the one four, and the other six inches in length. It is by means of these, according to *Pliny*, that this animal fishes; it puts out these slender horns among the mud, enticing the little fish to play around it till they come within reach, when it springs upon them, and devours them †.

Around the edges of its head are small fin-like appendages; outwardly there appear no apertures of the nose, but there are two within the mouth, supposed to convey smell ‡. About the middle of the back there rises a fin supported by ten rays; the tail is not forked, but the rays stretch somewhat beyond the membranes of the fin. The ventral fins are broad, thick, and fleshy, jointed like arms, and on the inner side divided into fingers, resembling what is seen on the foot of a mole §. With these instruments

2

* *Lophius piscatorius*, Lin. Syst. La Grenouille de Mer. Belon.

† *Plinii*, lib. ix. *Vide etiam* Cicero de Nat. Deor.

‡ Willough. ubi supra.

§ British Zool. and Willough.

instruments *Belon* asserts, that the animal walks at the bottom of the water.

Another pair of fins is placed farther out, at the verge of the body, and below there are the apertures of the gills, differing so considerably from those of other fish, that they have been supposed by some, to be a retreat for the young. They are large orifices, and at the bottom appears the branchiæ, resembling the teeth of a comb.

These fishes grow to an extraordinary size; some are taken near *Scarborough*, between four and five feet in length, and whose mouth are near three feet wide. The fishermen no sooner take them, than they give them their liberty, from the supposition that they destroy the dog fish; and in support of that idea, some of these voracious animals have been found in their stomachs.

Willoughby has four different species, which he has classed under this genus; three of which are *Brazilian* fishes, described by *Margrave*, the *Guacucuia*, the *Guaperua*, and the *Acaramucu*: Of these the *Guacucuia* or *Brazilian* water bat, resembles our fishing frog, in the shape of its body and the fins; but differs from it in the smallness of the mouth, in wanting teeth, and in the long protuberant snout, that resembles a horn. The whole body is variegated with white and black spots, of which the pencil, and much less the pen, is unable to convey any adequate idea*.

R 2

* Willough. page 89.

GENUS IX.—*The Sturgeon.*

THE fishes of this genus have only one narrow aperture on each side ; a circumstance in which they resemble the anglers above described. They have the mouth placed far below, tubular, and unprovided with either teeth or jaws* : Hence, these animals collect their food by suction ; and notwithstanding their size, which is often as large as that of the shark, they are the most peaceable and harmless of all animals. The sturgeon is as unwilling, as it is incapable to injure other fish : It flies before the most feeble, and timid of the race ; and not unfrequently falls a victim to its own apprehensions and fears †.

The sturgeons are gregarious and migratory : To the former of these habits, they are probably compelled by the timidity of their nature, and their incapacity for self defence : all the weaker animals that are peaceable and inoffensive, commonly trust to their numbers for security ; and hence, herd in great crowds together. The necessity of procuring food, of avoiding cold, or of providing a proper place for the production of their young, determines

* British Zool.

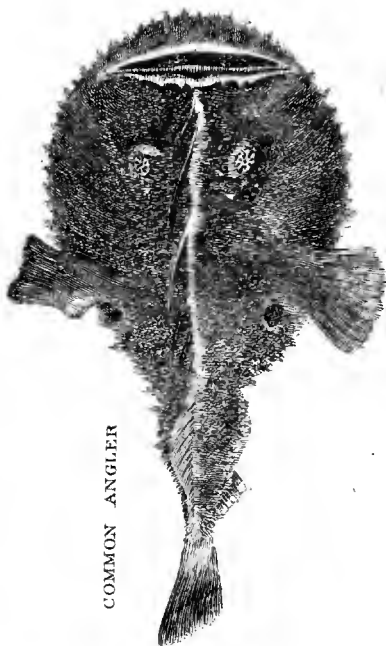
† Goldsmith's Nat. Hist.



Plate VIII.



STURGEON



COMMON ANGLER

determines the migrations of the sturgeon, as well as those of other fish. During the winter months they mount the rivers; while in summer, they betake themselves to the ocean; probably, however, never removing at any great distance from the shore*.

The Common Sturgeon †.

RONDELETIUS, *Gesner*, and *Aldrovandus*, have tedious disputations, whether this animal be the acipenser, or Elops of the ancients; a matter of very little moment, since, if the animal be accurately described, and well known, it matters but little by what name it was anciently distinguished.

The great resort of the sturgeons is the rivers of *Russia* and *Germany*; and as they are frequently found in the *Mediterranean*, at the mouths of the *Italian* rivers, it is highly probable that at least some species of them were known to the *Romans*: *Pliny*, however, as well as *Ovid*, mention the acipenser as a foreign fish ‡.

The common sturgeon is an inhabitant of the *British* seas, from which it ascends the rivers, and is sometimes taken in the nets set for salmon: It is there, however, found only in small numbers; the greater part consumed in this island is brought either from *North America*, or the *Baltic*. In the lakes of *Frischebaff*, and *Currischaff*, and in the rivers in the neighbourhood of *Pillau*, they
are

* Willough. Ichthyol.

† Acipenser Sturio, Lin. Syst. Acipenser, Rondelet.

‡ Pliny, Lib. ix. cap. 17. et Ovidii Halieut.

are taken during the summer months in great abundance, and sold over all *Europe* at a very high price. The shores in that vicinity are all divided into certain districts, and let as we do the salmon fisheries; some of them bring a rent of six thousand guilders, or near three hundred pounds *per annum* *.

In these large rivers they are sometimes found of two hundred pounds weight, and are taken in nets made of small cords. They are dull and spiritless animals, making but small resistance when entangled; and as soon as they are brought out of the water, appear like a lifeless lump. Their flesh is every where in high estimation; it has the delicacy, whiteness, and solidity of veal, and when roasted, is reckoned one of the greatest niceties that can provoke the appetite of an epicure †. It is commonly pickled, and packed up in casks, when sent to foreign markets: Of late, we have received a considerable quantity of these fish from *North America*, where they are caught in May, June, and July; it is at that season that they are seen leaping above the surface in the rivers, and falling again upon their sides, with a noise that is heard at the distance of some miles ‡.

It is of the ova of the sturgeon that the *Russians* make the caviar, by taking out the membranes found among them, and drying them, after having been washed with vinegar. The best caviar is said to be afforded by a small species called the sterlet, found in the *Taïk* and *Volga* §.

Ichthyocolla or isinglass is made of the sound of this as well as the other kinds of sturgeon ||. The ancients were acquainted

* Brit. Zool.

† Will. p. 240.

‡ Catesby Nat. Hist. of Carolina.

§ Strahlenberg's Hist. of Russia, p. 337.

|| Vide Phil. Transf. lvii. 354.

acquainted with the composition of this glue, so useful in many species of manufacture : It was probably made up by them in a similar manner, from a fish that had this very name * : It is useful as a glue for paper, musical instruments, and cementing every slender fabric of wood. It is well known to the varnisher, the apothecary, and the clothier.

The size of the sturgeon depends upon the place of its residence ; where it is confined either in fresh or salt water, it is comparatively small ; but where it alternately enjoys both, it grows often to the length of eighteen feet, and weighs from four to five hundred pounds ; of this magnitude one was caught in the river *Ejk*, in *Brittain* ; and in the larger rivers of the continent, some attain even to a superior size †. The body of this fish is long, and of a pentagonal form, on account of five rows of large bony scales, which proceed from the head along as far as the dorsal fin, one upon the back, and two upon each side. The head is small and protuberant at the snout ; the eyes are small in proportion to the fish, and the irides are of a silver grey : The mouth, without either jaws or teeth, is situated considerably below the extremity of the nose, and in the middle space between them, spring out a few bristles : The first pair of fins are placed immediately beside the gills ; the second pair near the anus, and a third between that and the tail ; upon the back there is but one fin.

The sturgeon differs from the other cartilaginous fishes in the manner of its generation ; like the spinous tribes it is oviparous, and deposits its spawn in the winter months ‡.

* Plinii, Lib. xxxii. cap 7.

‡ Brit. Zool.

† Rondeletius.

The Huso of Germany.

THIS species is supposed to be peculiar to the rivers of *Germany*; particularly the *Danube* and those streams that flow into it. From the *Black Sea* it ascends that river, and is caught in nets placed in different places to intercept it, nearly as far up as *Vienna*, where they are exposed to sale every Friday, to the number of sixty or an hundred. The flesh is soft, glutinous, and flabby; but it bears salting, and is exported from *Wallachia*, where it is principally taken, to the different markets of *Europe* *.

This fish, like the rest of the genus, is gregarious and migratory; and it is upon its excursions from the sea to the fresh water, that it is taken, during the months of October and November. The husos are from fifty to four hundred pounds weight, and are said to possess such strength, that they frequently drive the fisherman overboard with a stroke of the tail †.

It is chiefly for the isinglass which it affords, that this fish is taken: The manner of preparing this substance, is by cutting the skin, the entrails and the fins, into small pieces, and leaving them to macerate in a proper quantity of warm water; they are afterwards all boiled together upon a slow fire, until they are dissolved and reduced to a jelly; this jelly is spread upon instruments made for the purpose, and upon drying it assumes the form of parchment;

* Gesner de Aquatil. p. 59.

† Idem ibidem.

parchment; when it is rolled up, and exported in the shape in which we see it in the shops of the venders*.

The snout of this species is remarkably long, and furnished below with small barbs; on the belly are two pair of fins, on the back one; above, the body is black; the lower parts yellow, as in the perch; the whole surface is destitute of fins, and the flesh is supported by cartilages instead of bones†. The genuine ichthyocolla that produces the isinglass is supposed by *Willoughby*, to be a different fish from the huso.

* Goldsmith's Nat. Hist.

† Vide D. Will. apud F. Will. Ichthyol. p. 243.

SECTION VII.

GENUS X.—*The Diadon.*

THE cartilaginous class of fishes abounds with animals of anomalous and monstrous figures, which no pen can describe, and which even the pencil of the artist cannot imitate; such are the endless variety of orbs, of triangular and quadrangular fish described by *Clusius*, and after him by *Willoughby* *. They are mostly exotic animals, exhibiting the rich exuberance of nature on the warmer coasts of *America*, *India*, and the *Mediterranean*. From all these hideous animals, the *British* seas are happily free: Their utility to man cannot be discovered; their deformity is obvious, and the venomous nature of many of them has been so often confirmed by fatal experience, That it can no longer be doubted. From the distance of their situation, as well as their unattractive form, their history is but little known; we shall select, therefore, a few only for a particular discussion.

* *Ichthyologia*, p. 143

The Globe *.

THIS fish is seldom a visitor of the *British* coast; one, however, of the species was taken at *Penzance* in *Cornwall*. Its more common residence is off the shores of *Carolina*. It is of an oblong shape, of a foot and eight inches in length; the length of the globular belly, when extended, is above one foot, and its circumference, when in that state, is above two: This singular power of inflating its belly, till it acquires a globular shape of such magnitude, seems to have been intended by Nature as the defence of this animal; it is then of a size less easily laid hold of by its enemies, whilst the great number of spines with which its belly is surrounded, renders it an object of terror *.

The globe, upon the back, is of a rich deep blue; the sides and belly are white, shagreened or wrinkled, and beset with innumerable small spines, each attached to the skin by four processes. It has two pectoral fins; a dorsal one far back behind the globe, and opposite to that an anal fin.

* *Tetrodon lævigatus* Lin. Syst.

† Pennant. Class iv. gen. 9.

The Oblong Diadon *.

THIS species differs from the former, not only in wanting the globe, but in being much shorter; it resembles a carp, or some thick fish cut through by the middle. It sometimes grows to a very amazing size; some have been taken five hundred pounds weight†. It is commonly little more than two feet in length; so that the thickness, to afford nearly such a weight, must be very much disproportioned to the animal's size.

The body of this species is black above, and dappled; below it is silvery; it wants scales, but is covered with a thick, hard, and rough skin. The mouth is small for the size of the fish; between it and the eyes there are two apertures for the nostrils; but there are several other orifices in the head, the use of which has never been ascertained by any naturalist, though *Willoughby* supposes that two of them correspond to the organs of hearing in other animals‡.

The pectoral fins are placed immediately behind the eyes; they are small, and of a roundish shape; the dorsal and the anal fins are placed high, and at the very extremity of the body; the tail fin is semicircular, and fills up the whole abrupt space between them.

* *Ostracion Lævis*, Gronovius.

† Borlase's Hist. Cornwall.

‡ *Ichthyologia*, p. 151.

The short diadon is still a more awkward figure than this; it is shorter and thicker, having the anal and dorsal fins set still higher, which gives the body a more abrupt appearance. The flesh of both these is rank and unfavoury: When boiled, it turns into a kind of glutinous jelly, resembling boiled starch after it is cold; and from experiments made upon leather and paper, it has been found to answer the purposes of glue *. *Linnaeus* has enumerated seven species belonging to this genus †.

* British Zoology.

† Syst. Nat. 414.

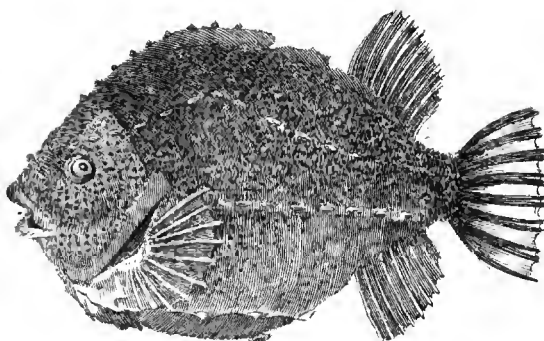
GENUS XI.—*The Sucker.**The Lump*.*

THIS tribe contains only three species, all remarkable for the singular deformity of their shape. The body is deep and thick; the back arched, and the belly distinguished by an oval aperture, surrounded with a fleshy and muscular substance, and edged with small thready appendages, which operate as so many clasps. It is by means of this apparatus that these animals adhere with such vast force to any substance to which they apply themselves. The tenacity, with which the sucker adheres to the bottom, has been tried by putting it into a pail of water, where it fixed itself so firmly, that on taking the fish by the tail, the whole vessel, with its contents, were lifted from the ground, although it held some gallons †.

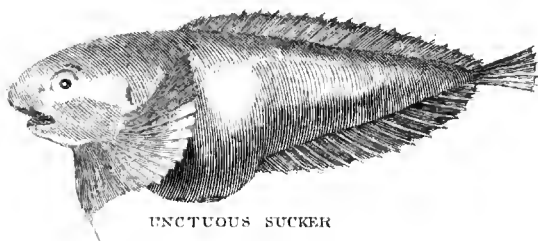
The lump sucker, which is the largest of this genus, increases to the weight of seven pounds, and the length of nine inches. The back is arched and sharp, of a blackish colour, dilated and variegated with brown. The belly is flat and reddish: it wants fins, but the whole body is defended with sharp black tubercles. On each side there are three rows of large bony scales, and on the
back

* *Lumpus Anglorum*, Will.† *British Zoology*.

Plate IX.



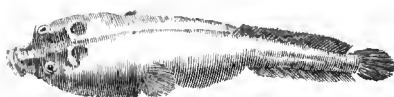
LUMP SUCKER



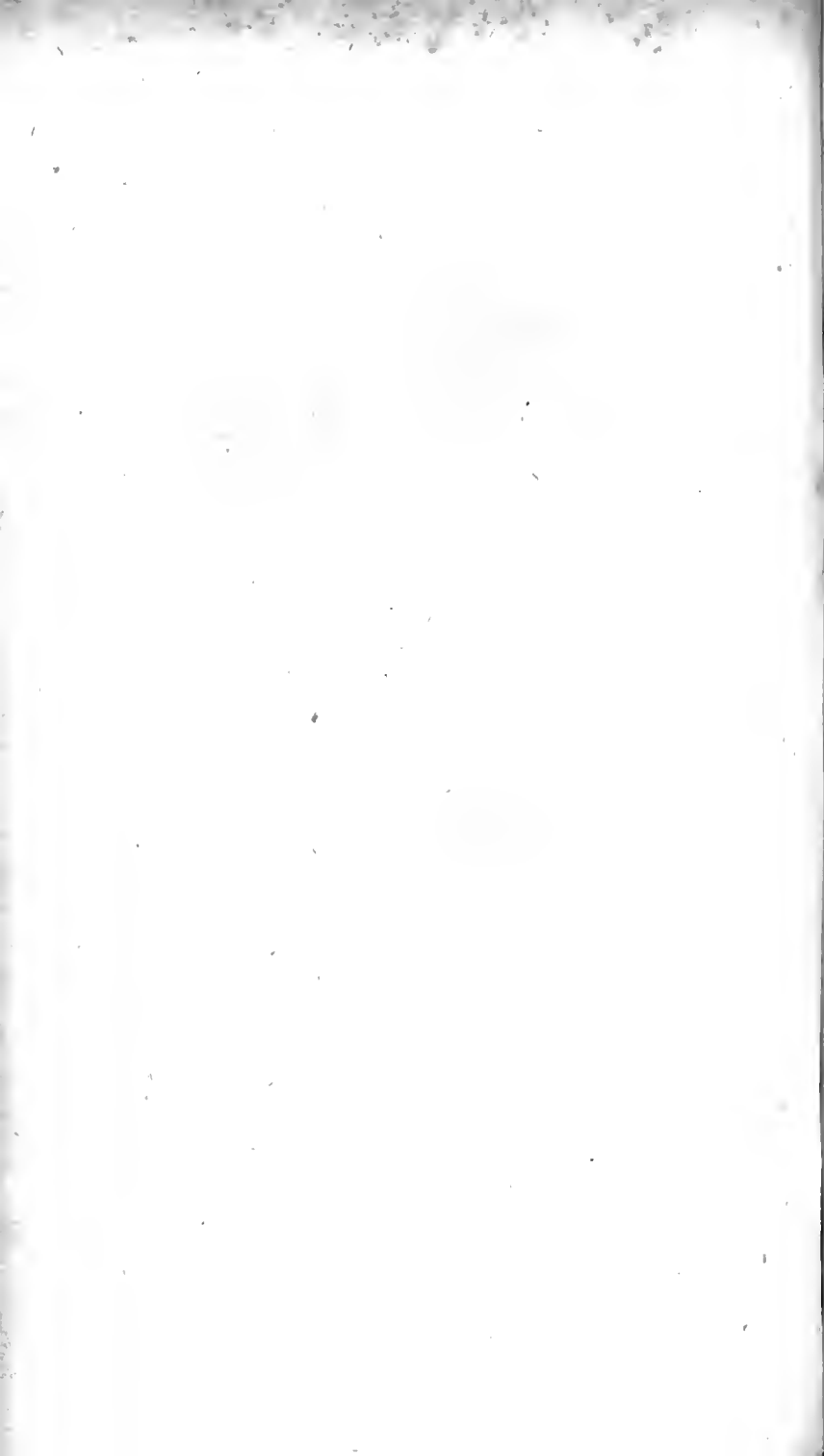
UNCTUOUS SUCKER



BIMACULATED SUCKER



JURA SUCKER



back a fourth. It has two pectoral, a dorsal, and an anal fin; the eyes are covered with a lax skin, the irides of a pale red; the lips are thick, fat, and ruddy; the orifices of the nose appear one on each side, raised above the surface of the rest of the skin*.

The lump fish is caught on several parts of the *British* coasts; and though its flesh is held in no great estimation, it is frequently seen for sale in the *London* market. The great resort of this species, is the north sea upon the coasts of *Greenland*. While it prowls upon the top, the seals swarm beneath, watching an opportunity to devour it. Infinite numbers fall a prey to these animals, who swallow all but the skin; vast quantities of which, thus emptied by the seals, are seen floating above during the spring months, when the suckers approach near the land, for the purpose of depositing their spawn. Every district where the seals carry on their depredation, is easily distinguished by the sailors, on account of the smoothness of the water: Wherever any oily fish has been devoured below, the water at the top becomes tranquil, it being uniformly found to be a property of oil to calm the agitation of the waves†.

The inhabitants of the barren tracts of *Greenland*, who are obliged to draw a great part of their sustenance from the sea, avail themselves also of this fish; the roe is remarkably large, and in the summer months they take them on account of it; when boiled, it forms an extremely fat, oily food; a kind of repast, of which the necessities of the *Greenlanders* have rendered them exceedingly fond‡.

* Willough. page 208.

† Phil. Trans. 1774. p. 445.

‡ Crantz's Hist. Greenland.

The Sea Snail *.

THE whole of this fish, the head as well as body, is soft and unctuous, easily soluble into a kind of oily fluid; it is on this account that it has obtained the name of snail. Its habitation is not properly in the sea, but about four or five miles from the mouths of large rivers, where the water is beginning to be salt. The body of this species is transparent, of about five inches in length; and when newly taken, the colour is pale brown †.

The head is thick and round; the mouth without teeth, each jaw being only a little rough. The aperture of the gills is small, covered with a valve or operculum, which springs from the base of each of the pectoral fins. These fins are very broad, thin and transparent; and below the throat, they almost unite together. Below the throat, there is observed a round spot resembling the impression of a seal, the place which the animal applies to those substances to which it means to adhere. The anal and dorsal fins continue without interruption, till, like those of the eel, they meet at the tail ‡.

* *Liparis nostras*. Will. *Cyclopterus liparis*. Lin. Syst.

† Will. Append. 17.

‡ Brit. Zook.

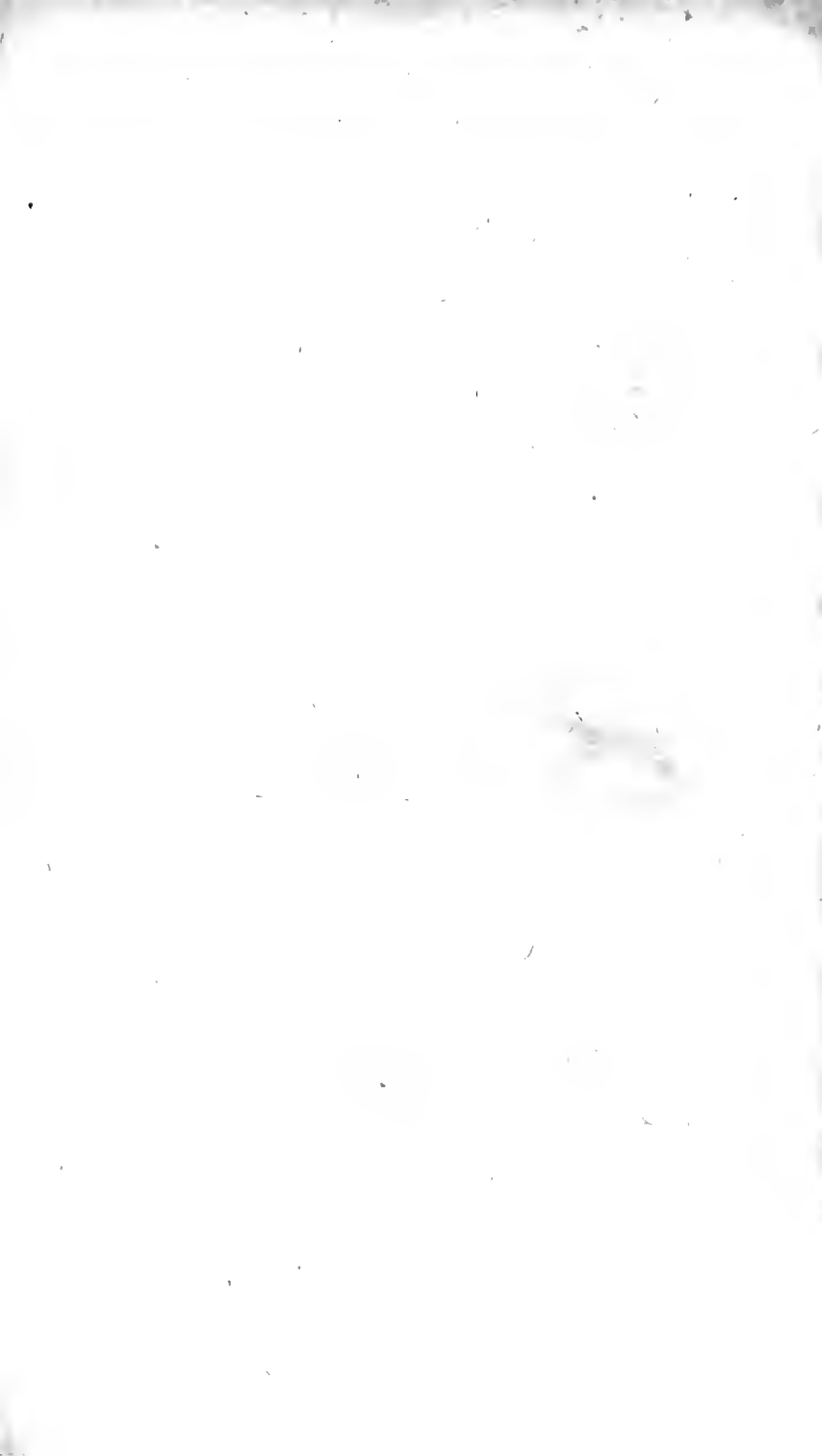
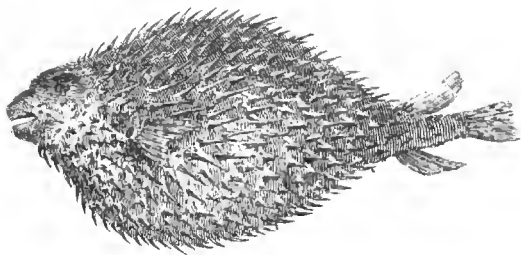
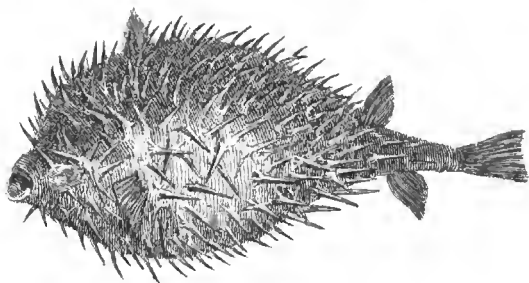


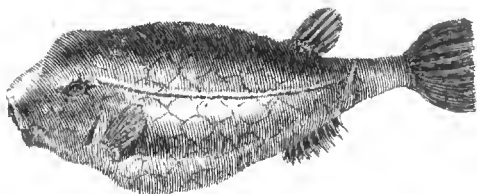
Plate X



SEA PORCUPINES



OSTRACION



GENUS XII.—*The Sea Porcupine* *.

THIS animal is placed among the orbs or globular fish, by *Willoughby*; of all the inhabitants of the sea, it is the most completely furnished by nature with defensive armour. Instead of scales, the whole skin is covered with strong sharp spines, which are firmly inserted into it at the base. These are all laid flat when the animal is at rest; but when alarmed, they all around stand upon end, so that the fish is inaccessible upon every quarter. There are various kinds of these animals; all, however, seem equally possessed of the power of raising or depressing their spines at pleasure, and by that means of increasing the terror of their appearance in proportion to the approach of danger.

Together with the power of erecting their spines, they possess also that of inflating their bodies on the appearance of an enemy. This operation is performed by means of a bag within the body, which, by being filled with air, inflates the fish to a prodigious size: An animal of this tribe, that at first view seems small and inoffensive, is no sooner alarmed or provoked, than it swells to the view, the whole body becoming visibly rounder and larger; while in the mean time all its prickles stand upright, and threaten the invader on every side †. The *Americans* often amuse themselves with the barren pleasure of catching these frightful creatures, by a line and hook baited with

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T

a piece

* *Histrix*, Clusii Exot. *Histrix*, Linn. Syst.

† Goldsmith's Nat. Hist.

a piece of sea crab: The animal approaches the hook with its spines flattened; but when hooked and stopped by the line, all its spears are instantly erected, and the whole body is armed so completely at all points, that it is impossible any where to lay hold of it; it is therefore dragged to some distance from the water, and there it quickly expires.

The body of this species is about twenty inches long, and twenty-nine in circumference round the thickest part. The mouth is a little prominent, and when opened, about three inches in diameter; the eyes are pretty large, and rendered horrible in their aspect, by four spines rising immediately above each of them. The two pectoral fins are about three inches long, and five broad; the dorsal and anal fins are nearly of the same dimensions *.

* Vide Clusium apud Will. p. 140.

GENUS XIII.—*Ostracion* *.

OSTRACION is the generic name adopted by *Linnaeus* for nine different kinds of anomalous fish which he has enumerated, all inhabitants of warm climates, and all agreeing in having the body covered with a bony coat of mail †. Some of them want horns; others have two, and some four: They are of various shapes and sizes, and from their appearance, hardly seem entitled to rank with this class of the animal kingdom.

The species here described was sent from the *East Indies*, and is about fifteen inches long, and four deep: The forehead appears flat, and even concave, on account of two large eye-brows that project over it; the eyes are about an inch in diameter; below them are the two small foramina of the nostrils; the mouth is hardly an inch in width, and furnished with very minute teeth. The body is of a quadrangular shape, and moved by five fins; of these, the two branchial are square, being two inches broad by two long: Resembling these, are other two situated near the tail, the one above and the other below; the tail fin is three inches in length, by three and a half in breadth. The whole body is covered with a crustaceous substance, resembling that of the pale blooded fishes of that order. This crust is strengthened and ornamented by a great

T 2

number

* *Ostracion* prior *Aldrovandi*.

† *Systema Naturæ*, genus 136.

number of tubercles of triangular shape, and in substance is something of the nature, partly of skin, and partly of a shell. There are some varieties of this species *. Of the orbs, or globular fish, *Willoughby* enumerates no less than thirty different species; concerning which, however, very little is known, but the name and the external figure: His orbs comprehend two or three different genera of the *Systema Naturæ*, *Linnaeus* having improved the arrangement given by preceding naturalists.

* Will. Ichthyol. p. 148.

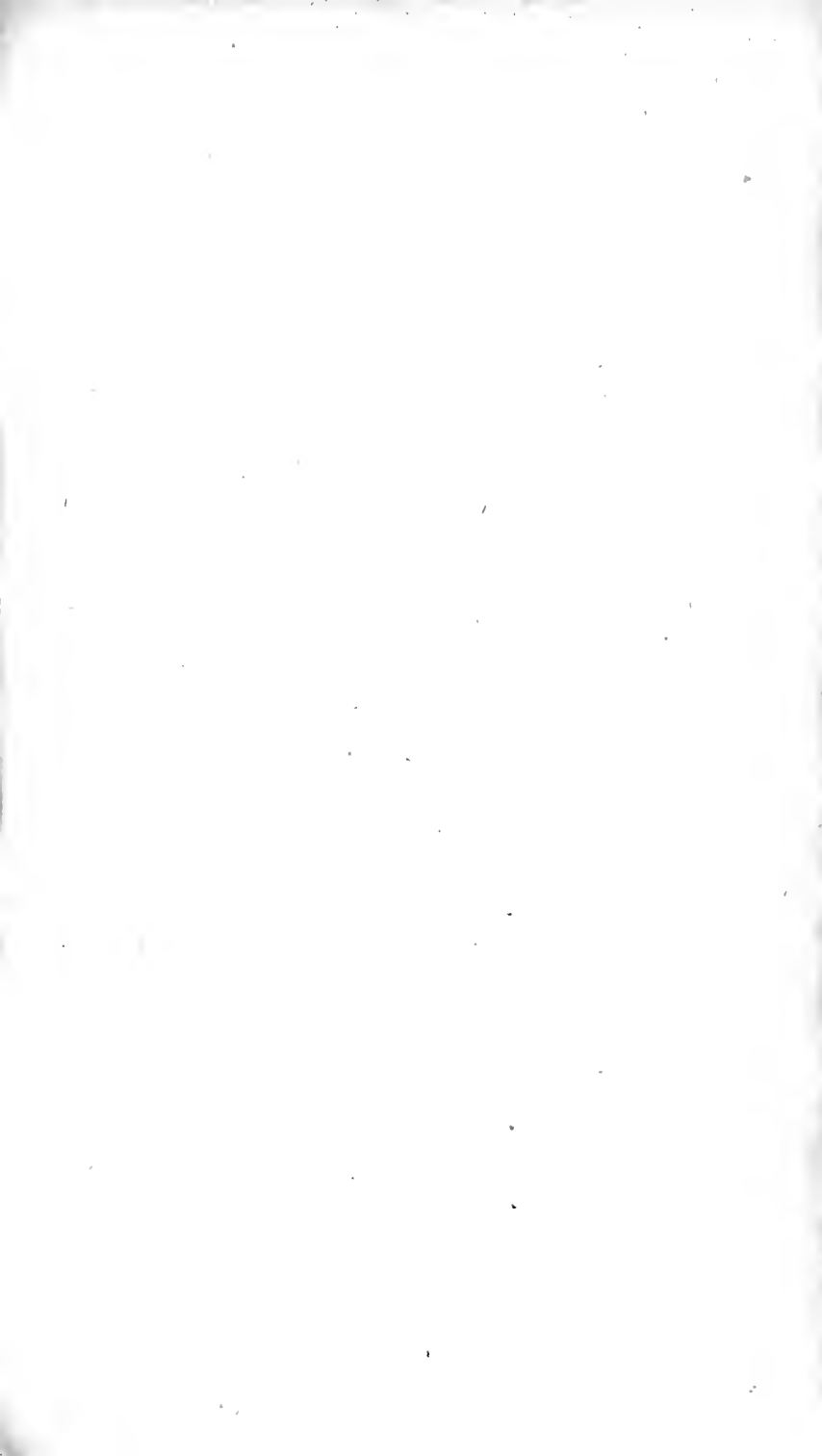


Plate XI



LONGER PIPE FISH



SHORTER PIPE FISH



LITTLE PIPE FISH

GEN. XIV.—*The Pipe Fish.*

THIS genus comprehends all those fishes that are known by the name of sea adders, and sea horse: *Linnaeus* has enumerated seven different species, of which the generic characters are, a long and tubular nose, no orifice to the gills, but the breathing aperture situated on the back part of the head; the body is covered with a strong crust; and in all, the ventral fins are wanting*.

The Longer Pipe Fish†.

THIS species, as described by *Sir Robert Sibbald*‡, is two feet long, the nose an inch in length, and compressed laterally; at the end of it is a small orifice for the mouth. The thickest part of the body did not exceed the circumference of a swan's quill; trexangular from the head to the dorsal fin, the rest quadrangular. The belly, carinated, and marked along the middle with a dusky line§.

The

* Vide *Systema Nat.*† *Syngnathus barbarus*, *Lin. Syst.*‡ *Scotia illustrata*, 24. Tab. 19.§ *British Zool.*

The colour of this species is an olive brown, marked with bluish lines, and, toward the tail, with brown spots. The pectoral fins have each twelve rays, the anal two, and the dorsal, which was two inches long, has forty. Between the vent and the tail, is a groove six inches and an half long, covered by two valves. This is the receptacle for the young; and as these animals are viviparous, on treading upon this part, hundreds of living young, are seen to creep out around the parent fish.

There are three species of the pipe fish found in the *British* seas; the longer, above described, the shorter, and the small pipe fish, or ophidion of *Linnaeus*. The last seldom exceeds five inches in length, is very slender, and tapers off to a point at the tail, having no fin there. The pectoral fins are also wanting, and the body is covered with a smooth skin, instead of the crust peculiar to this genus. This species is not viviparous, and consequently the groove under the belly, does not contain living young, but eggs, which are large, and not very numerous.

The Hippocampus, or Sea Horse *:

THIS animal has obtained its name from the resemblance its head bears to that of a horse †: It bends the body into different curvatures, like an eel; and is marked all over with circular incisions, resembling those of the insect tribe.

* Hippocampus, Lin. Syst. Cavallo. Marino Italor

† Gefner de piscibus.

tribe. It is only nine inches in length, and often less, while its thickness is not above an inch: The snout is oblong, without any fissure at the mouth; at the lower end of which appear the foramina, with an operculum to cover them*. The body is furnished with acculeated knobs, and is of a pentagonal shape, till it reaches the anus, from which, to the tail, it is quadrangular. The eyes are round and prominent; behind them, in place of the gills, which are here wanting, there are two small fins, resembling the external ears of terrestrial animals. Under the belly there are two orifices; one for voiding the excrement, and the other for the emission of the young in their egg state.

The colour of this animal is a dark green, the belly variegated with light blue spots. In the middle of the back rises one dorsal fin, with sixteen rays. Some species have hair along the back, resembling the mane of a horse. They are caught in different parts; that which *Willoughby* describes, he saw at *Baice*, not far from *Naples*. It had no mane; he concludes, that that ornament is either characteristic of one of the sexes, or of a different species. In his plates, he has given the figure of three different kinds†.

* Willough. page 157.

† Vide Willough. Ichthyol. p. 158.

CHAPTER VI.

ORDER III.—*Spinous Fishes.*

SECTION I.

General Characters of this Order.

WE are now come to that order of the finny tribe, to which the later naturalists have exclusively appropriated the name of fish: According to them, the cetaceous kinds are beasts, that have taken up their abode in the ocean; and the cartilaginous, an amphibious band that are but half denizens of that element; the spinous fishes being alone entitled to that appellation*. After detailing the history of the two first orders, we have seen that there are particularities in their conformation, which, in a philosophical view, perhaps justify the arrangement of these naturalists, to whom science is much indebted. While therefore, we have availed ourselves of their method of placing the different genera, our veneration for the ideas and the language universally established among men, has induced us to rank all the inhabitants of the same element in one class, and to distinguish them by a common name.

‡ Goldsmith's Nat. Hist. vol. vi. page 299.

The first peculiarity that strikes us, with regard to the fishes of the spinous order, is the greatness of their numbers. Not only are the individuals of each family more numerous; but the variety of the kinds is also far greater. Upwards of four hundred different species of spinous fishes are already known and described; while the cetaceous and cartilaginous orders, when taken together, hardly amount to a fifth of that number*. The former, are in general inferior in size; and it is conformable to a law, which obtains in every department of the animal kingdom, that the smaller the productions of nature are, the more numerous and diversified in form does she yield them. A very valuable purpose in the economy of providence, is gained by this constitution of the animal kingdom; for, since the smaller tribes are in general destined to become the prey of the larger, an adequate provision is made for the supply of every kind; none entirely perishes through want; none is ultimately extirpated by depredation.

It is by the numbers, therefore, of the spinous fishes that the other orders are preserved, and their own perpetuated. In them, as we have already observed, generation is performed, not by producing a living animal, or by hatching a distinct egg, but by spawning innumerable ova, that are quickened into life by the heat of the sun, and are destined to supply the annual waste of millions. Hence the powers of fecundity in this order, exceed belief, and in a short space defy calculation. A single herring, if suffered to multiply unmolested, and undiminished for twenty years, would shew a progeny greater in bulk, than the globe itself†. It is owing to this exuberant

* Linnæus has four hundred spinous fishes.

† Goldsmith says above ten times greater, Nat. Hist. vol. vi. page 335.

rant fertility, that the herring, the pilchard, and some others, are obliged to migrate annually, from the artic regions, in shoals of such vast extent, that for miles they are seen to darken the surface of the water.

But the amazing propagation of fishes, which we witness along our coasts and rivers, bears no proportion to the vast quantities that swarm in the warmer latitudes of the *Indian* ocean. The inhabitants of some of the islands there, are, it is said, under no necessity of providing instruments for fishing: As they approach the shore, they are found in great numbers, in the plashees, where the water remains after the ebbing of the tide. In some places where these swamps are dried up by the sun, the fishes are left in such shoals, that they communicate by their putrefaction, a noxious and unhealthy tincture to the atmosphere.

Happily, however, for the purity of that element, and the health of those beings which it supports in life, the waste of these fishes is nearly proportioned to their fecundity; and the balance of nature is exactly preserved. The shark, the porpessie, and the cod, we ought therefore to consider not so much in the light of plunderers and rivals, as that of benefactors to mankind: Without their exertions, the sea would soon be overcharged with the burthen of its own inhabitants; and that element, which at present distributes health and plenty to the shore, would in a short time load it with putrefaction*.

The generation and growth of fishes, and particularly of the oviparous, are involved in great obscurity. The common opinion, as we have already stated, is, that im-
pregnation

* *Idem ubi supra.*

pregnation is performed without the body of the female, by the male ejecting the smilt, and mingling it with her ova. Something, however, like pairing and copulation, has been observed among the fish kept in ponds. At a certain period, the sexes are seen struggling together among the grafs, at the brink of the water. It is then that the scales of some grow rough, and lose their lustre; that others grow thin, lose their appetite, and become flabby. Should their copulation be established by farther observation, their manner of generation would be more analogous to that of the rest of the animal kingdom.

It is never yet ascertained, whether all the fishes of this order, when they first attain to animation, and burst from the egg, leave it perfect animals, or in a tadpole state, as is the case with the frogs, and many of the lizards. The young frog is first ushered into life, with an enormous head, and slender tail; but the tail soon after drops off, the head diminishes, the legs appear, and the tadpole is metamorphosed into the quadruped, when it changes its element, as well as its form. A species of the lizard also, which is excluded from the shell without legs, acquires them by degrees, and after some time leaves the serpentine shape. Some fishes, it is probable, in like manner suffer a change, though too imperceptible to attract the notice of the observer. In support of this idea, it is well known, that during the month of July, there appear in the *Thames* innumerable shoals of small fish, called *white bait*, that are universally allowed to be the young of some species abounding there. They have no roe; a circumstance which proves them to be young: they resemble no other fish exactly; from

which the conclusion is, that they undergo a change before they arrive at maturity.

The general character by which naturalists distinguish the spinous fishes from every other, is that bony operculum, which, in this order, universally covers the gills on each side. By these coverings, the gills are alternately opened and shut; and the spinous fishes breathe by these organs alone, without any assistance from lungs. Hence, as these animals partake less of the conformation of quadrupeds, than the two orders which we have already examined, so they can in general remain a shorter time out of their proper element: When taken from the water, they testify their suffering, by panting more violently, and at closer intervals; the thin air furnishes not their gills with proper play, and in a few minutes they expire.

But the spinous tribes are not all equally incapable of supporting life in the open air; some are tenacious of it, even in that element. The eel will live several hours out of water; and the carp has been known to be fattened in a damp cellar. The manner in which this process is conducted, is by putting the animal in a net, wrapt up in wet moss, the mouth only disengaged, for the convenience of feeding: The nourishment with which it best agrees, is white bread and milk; and upon this food it will fatten more rapidly, and become better flavoured than when fed in the pond. It is necessary, however, that the net be dipped frequently in water, and kept hanging in a damp vault. From this experiment, it would appear, that the want of moisture to the gills, is the cause of death in these animals; and could that be supplied, the vital functions might be carried on nearly as well in the one element, as in the other.

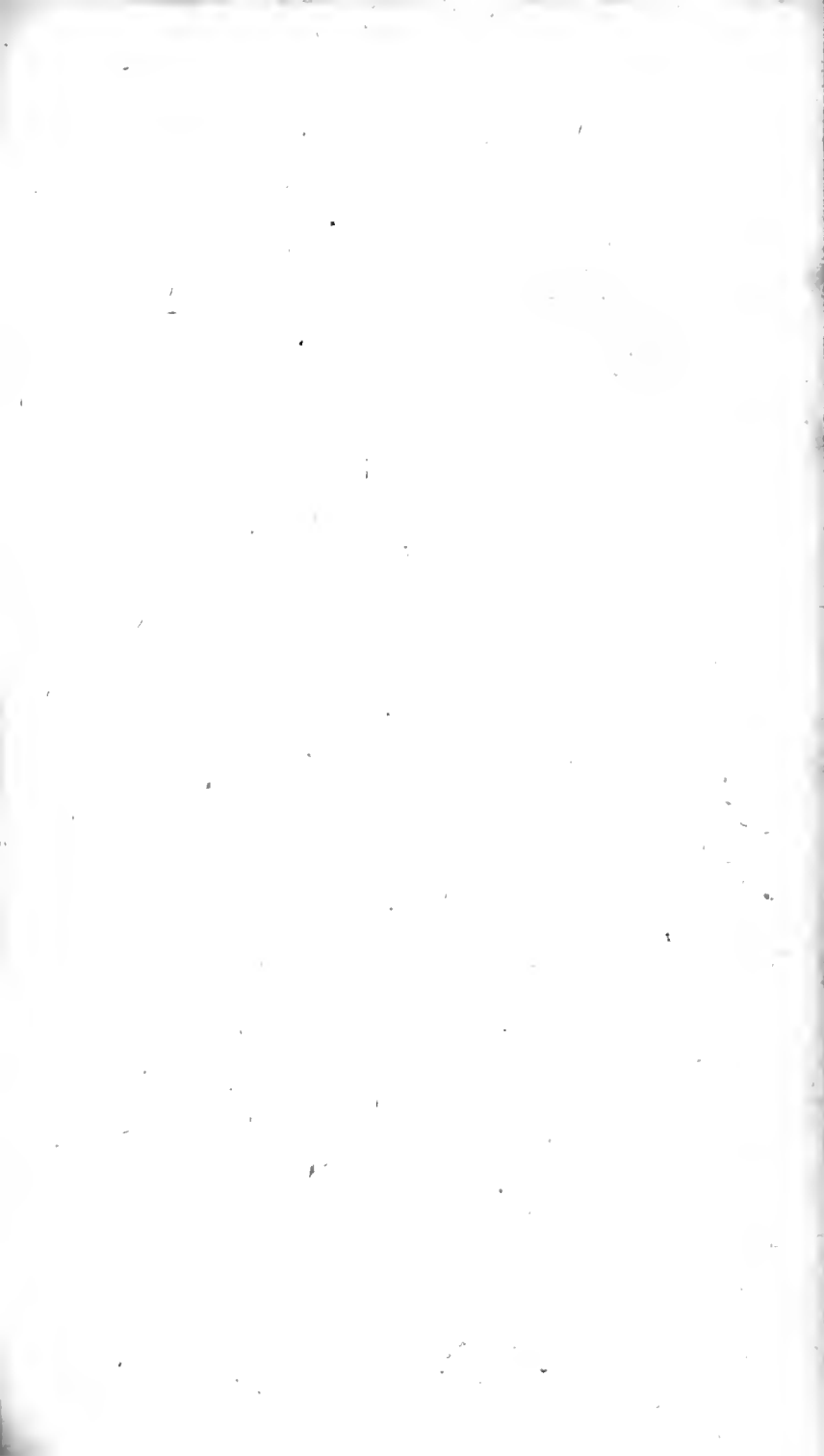
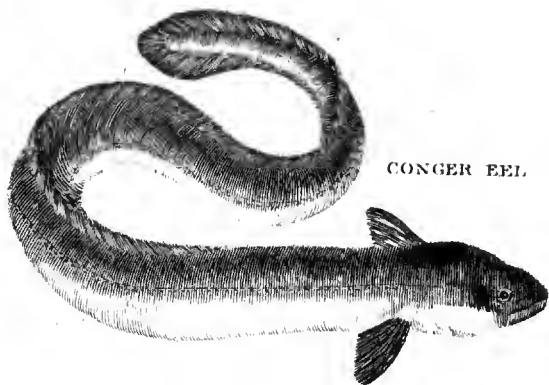


Plate XII.



EELS



DIVISION I. *Of Apodal Fishes.*

SECTION II.

GENUS XV. *The Eel.*

IN forming this genus, nature seems to have made a near approach to the reptile tribes; like these animals, the body is long, slender, and flexible. Excepting the small pair of pectoral, it may be said to have no fins; for the dorsal, anal and tail fins are united in one web, which surrounds a large portion of the body. The apertures to the gills are small, and placed behind the pectoral fins; they are covered by ten branchiostegous rays.

The eel differs from almost every other fish of that order, of which it is placed at the top, in the manner of its generation. It is viviparous, and is impregnated in the same manner which obtains among the cartilaginous tribes. The ancients entertained very extravagant notions concerning the generation of these animals. *Aristotle* asserted, that they were neither male nor female, had no ova nor semen*. Hence it was believed that they sprung from the mud, or that the incrustations scraped from

* *Vid. Hist. Animals.*

from their bodies by the stones, received animation: *Rondeletius* rashly adopted this opinion, from having observed that they were generated in pools, from which all the mud and water had been for a while extracted*. This was a phenomenon, for which they could in no other way account, than by the spontaneous generation of eels: But later observations have ascertained, that ponds are often supplied with these fish, in the same manner that vegetation is spread, by transporting the seeds of plants. The heron, or other water fowl, may drop the eel, when carrying it to its young, or the young may be ejected unhurt from its bowels, as the seeds of plants are voided by land birds, without being injured by the operation of the stomach.

In their habitation, the fishes of this genus are still more singular, than in their manner of propagating their young. They can reside either in salt or fresh water†; and what is still more surprising, they are in some measure independent of either; for they sometimes leave their native element, and wander, during night, along the dewy meadows, not only for a change of habitation, but in quest of prey‡. Of these nightly excursions, the snail is commonly the victim, being devoured by the eel as it passes along.

There is no animal more vivacious than the eel; when drawn from the water, it will survive blows that would have killed an animal ten times its size; and even after it is cut asunder, the different parts are seen to move§. It is, however, so easily destroyed by cold, that to avoid it, it beds itself deep among the mud, and continues, like
the

* De piscibus.

† Rondelet. de Piscibus. 199

‡ Brit. Zool. class iv. gen. 12,

§ Idem ibidem.

the serpent tribe, in a torpid state during winter. Some have been known to take shelter under a rick of hay in severe weather, and even there, have all perished from excess of cold *. Though fond of hiding themselves in the mud, they are incapable of living in thick turbid water; and hence, when a river is disturbed by a flood, they are frequently suffocated by the impurity of the stream †.

The Common Eel ‡.

THE external figure of this fish is too well known to require a minute description. The body is long, round, and tapering, compressed towards the tail, and above of a blue colour, tending to yellow on the belly. The river eel has no scales, the body being all over lubricated with a viscous substance, serving at once to protect the animal from cold, and external injury. Those which are fed in pure running water, are brighter in their colour, as well as more delicate in their flesh §.

The irides are white, and near the eyes, are seen the orifices of smell. The branchiæ are four in number, covered with a skin, and extremely small: the aperture externally communicating with them, is so minute, that it occasions their suffocation in muddy water, and is probably the cause why they are capable of living so long in the open air ||.

There

* Albertus apud Gesner, page 45. † Willough. page 110.

‡ *Muræna Anguilla*, Lin. Syst. *Anguilla* Plinii, lib. ix.

§ *Idem ibidem*.

|| Rondelet. de piscib. lib. i. cap. 9.

There are several varieties of the common eel, probably occasioned by the different food on which they are supported. These animals are all extremely voracious; they devour carrion or any putrid substance that falls in the way*: They are capable of subsisting equally in fresh water, or in salt, and thrive either in a stream or in a pond, and even in wells†; but though a fish almost universal, naturalists seem agreed, that there are none in the *Danube*, nor in any of those streams which flow into it; while they are found in all the branches of the *Rhine*‡.

This species often grows to a pretty large size, some weighing seventeen pounds; there is indeed an inferior kind in the *Thames*, and about *Oxford*, which neither attain to the same size nor fatness; they are known by the largeness of the head, and the roundness of the snout, and have there received the appellation of grigs. Every species of the eel was deemed among the *Romans* contemptible food, according to *Juvenal*, from their foul feeding, and their resemblance to a snake.

The Conger Eel §.

THIS often grows to an enormous size; some are taken eighteen inches in circumference, and ten feet long, weighing

* Brit. Zool.

† Rond. ubi supra.

‡ Albertus.

§ *Muraena Conger*, Lin. Syst. *Le Congre*, Belon.

weighing upwards of an hundred pounds. A fishery of congers established at *Mount's Bay*, in *Cornwall*, forms a very considerable article of commerce. They are annually exported to *Spain* and *Portugal* in a dried state, where they are grinded down into a kind of powder, and are used in enriching their soups *.

They are caught by a sort of line called a bulter, baited with pilehards ; when taken, they are slit up, that a part of the fat may exude from them before they are salted, and fit for use ; and so considerable is the quantity of juice that thus escapes, that a fish of a hundred weight will not dry to above twenty-five pounds. *M. Pennant* supposes that a fishery of congers might be established with advantage in the *Hebrides*, could the aversion of the natives to this tribe be overcome.

This species is distinguished by the same voracity as the former ; it devours other fish, crabs, and even carcases. The mode of its generation is probably the same with the common eels ; but, however this be, it is certainly prolific, for the number of its young that annually ascends the *Severn* is prodigious ; they are there called elvers, and during the month of April they swarm in such shoals, that they are thrown out upon the shore with small sieves made of hair, and fixed to the end of a pole ; a man will in this manner take out as many at one tide, as will fill a bushel †.

The conger differs from the common eel, in having the eyes larger in proportion ; the irides of a bright silvery colour, the lateral line marked with a row of small spots ; the edges of the dorsal and anal fin black, and in having a greater number of bones.

* Brit. Zool.

† Vide Gessner, apud Will.

The Sea Serpent *.

THIS hideous animal may be referred to the genus of eels, which in its external figure, it nearly resembles. It is generally about five feet in length, slender, and almost entirely of the same thickness, till near the tail, where it tapers off in a small point. The upper part of the body is of a dirty yellow, the under, bright blue. The snout is long, slender, and prominent, divided by a frightful mouth; armed on the inner parts with small teeth, eight or nine of a larger size being placed before, and on the middle of the palate. The eyes are small, of an oblong shape, placed obliquely in the direction of the body; the irides of a gold colour, interspersed with brown spots. This species has only two pair of fins, inserted near the gills, and strengthened by sixteen cartilaginous rays. There are two spotted lines, arising from a common point on the back part of the head, and stretching in a parallel direction along the sides, till they terminate about two inches from the extremity of the tail. The tail is not compressed as in the eels, but round, and fimbriated, with no fins; neither the anal nor dorsal reaching to its extremity †.

There are several other kinds of sea-serpents, some spotted, and others red; but as these are mostly foreign fishes,

* *Serpens Marinus*. Rondel. Sea serpent, Will. 107.

† Willough. page 108.

fishes, whose history is altogether unknown, we forbear to enumerate them, and to tire the reader with the barren and uninstruative discription of their forms *. One species, however, of the eel tribe deserves our notice, because it has been found to possess the same narcotic powers as the torpedo; it is the *gymnotus electricus* of *Linnaeus*, called by the *English* of *Jamaica*, the torporific eel: This singular fish is only found in the interior parts of *South America*, particularly in the lakes of *Surinam*, from whence it has been transported to *Jamaica*. Different attempts have been made to introduce it into *Europe*, but without success. If touched with the hand, it communicates a strong shock to the arm; and the same effect is produced by applying it to a metallic rod, whereas it is harmless when touched with a piece of wood. From these experiments it appears certain, that the matter discharged by the torporific eel, partakes of the nature of the electric fluid. The tribe of gymnoti in which *Linnaeus* places this animal, comprehends five different species; of the eels, properly so called, he enumerates only seven kinds †.

* Vide *Rondel. et Aldrovand.*

† Vide *Syst. Nat.*

SECTION III.

GENUS XVI — *The Sea Wolf**.

THIS voracious fish inhabits the northern parts of the ocean; it is found on the coasts of *Ireland* †, *Greenland*, and *Norway*, but seldom ventures farther south than those parts of the *German Ocean* which wash the shores of *Britain* ‡ and *Holland*. The back, fins, and sides, are of an azure hue; towards the belly it is white, and the whole skin is smooth §.

What particularly distinguishes this animal, is its large mouth, and formidable teeth; the fore teeth are ten or twelve in number upon each jaw, round, conic and sharp; behind these are the grinders, round and flat, about twenty-four in number; upon the bones of the palate are three rows of similar teeth. There is no fish seems more completely armed for devastation than the sea-wolf, and none more willing to use the instruments with which nature has supplied it; it will gnaw even the anchor of a ship, so that the noise is heard above; the marks of its teeth are plainly discernible on weighing it up ||.

The

* *Anarhicas Lupus*. Lin. Syst. Cat-fish, Sibbald.

† It is there called Steinbeisser,

‡ Schonf. 45.

§ Brit. Zool. Class iv. gen. 13.

|| Will. p. 136.

The teeth of this fish are frequently dug up in a petrified state, where they are called bufonites, or toad-stones; formerly they were much esteemed for their imaginary virtues; they were sometimes set in gold, and worn as jewels*; the teeth of three large fishes of this species, were seen at *Scarborough*, every one of which were either broken or disfigured by the hard substances which these animals had attempted to macerate†.

Both the dorsal and anal fins of this fish extend almost to the tail, which is round at the end, and strengthened by fourteen rays; the pectoral fins resemble two small wings, being about five inches long, by seven broad. The food of the wolf fish is crustaceous fishes, the shells of which it can easily comminute. These animals are oviparous; and their young, for some time after their production from the egg, are of a greenish cast, resembling the sea weeds among which they then reside; some of them have been caught in the *Frith of Forth*.

* British Zool.

† Willough. p. 130.

GENUS XVII.—*The Sand-Eel, or Lance* *.

THESE fishes somewhat resemble the eel in their external form, as their name imports. They are dug or hooked up from the sand in the shallow pools that are left by the reflux of the tide, commonly for bait, though they are themselves reckoned delicate food. The sand-eel has frequently been found in considerable quantity in the belly of the porpessie, which confirms the account we gave of that animal digging up the sand in searching for its prey. *Linnaeus* has only one species belonging to this genus, that which we frequently see dug up along our shores.

The body is nearly a foot long, of a square form, but rounded towards the sides, which are divided, each by a strait line proceeding from the head, and terminating in the tail; the lower jaw projects beyond the upper, and when extended, the gape of the animal is very wide; there are no teeth, the long sharp tongue moving in a mouth entirely smooth; the pectoral fins are placed near the gills; the dorsal and the anal fins are supported by numerous rays, and proceed nearly as far back as the tail †.

* *Ammodytes Tobianus*. Lin. Syst. *Ammodytes Gesneri*

† Willoughb. p. 114.

GENUS XVIII.—*The Ophidium* *

THE fishes of this genus are two ; the one has a number of barbs hanging over from the lower jaw, while the other wants these, but in all other respects appears the same. The ophidium has a great resemblance, in shape, to some of the tribe of eels, but is of inferior size. *Be-lonius* asserts that those in the *Mediterranean* are not above a handbreadth. The back is cinereous ; the sides of a silver colour : There are no scales, but in their place a number of oblong spots here and there dispersed over the body ; the mouth is large, and exasperated with a number of small teeth round the palate and jaws ; the eyes are large, covered with a pellucid membrane : There is only one pair of fins near the branchiæ ; the dorsal fin takes its rise not far behind the head, from whence it proceeds along the back, furrounds the tail, and terminates below at the anus. The body is exactly divided by a lateral line, which extends along each side from the head to the tail †.

Ophidion Plinii. Ophidium, Guan.

† Vide Guan. Hist. Piscium, p. 117.

GEN. XIX.—*The Stromateus* *.

LINNÆUS enumerates two species under this genus, the fiatola and the parda †. The characters are, a round flat body, covered with a smooth glutinous skin, and destitute of scales ‡. The size of the fiatola or lampuga, as it is called by the fishermen of *Rome*, is nearly a foot, and its weight a pound and an half; the colour of the upper part of the body is pale azure, that of the belly silver; the whole beautifully ornamented with yellow spots; upon each side are two lines, the one straight, and the other incurvated like a bow §; the snout is flat, the mouth small, and the tongue smooth, fleshy, broad, and moveable; the eyes are small, and covered with the common membrane that surrounds the head; the pectoral fins are furnished with a great number of rays, and the ventral are wholly wanting; the dorsal fin rises about a third part of the total length from the head, is supported by forty-six cartilaginous rays, and is prolonged till within less than an inch of the tail; the anal fin nearly resembles it in shape, and takes its rise still nearer to the tail.

Willoughby observed these fishes exposed in the markets in different parts of *Italy*, where they are reckoned most delicate food, and bring a high price; none of them have yet been found in the *British* seas.

* *Stromateus*, Rondel. *Callichthys*, Belon.

† *Syst. Nat.* 169.

‡ *F. Guan. Hist. Piscium.* p. 173.

Will. p. 156.

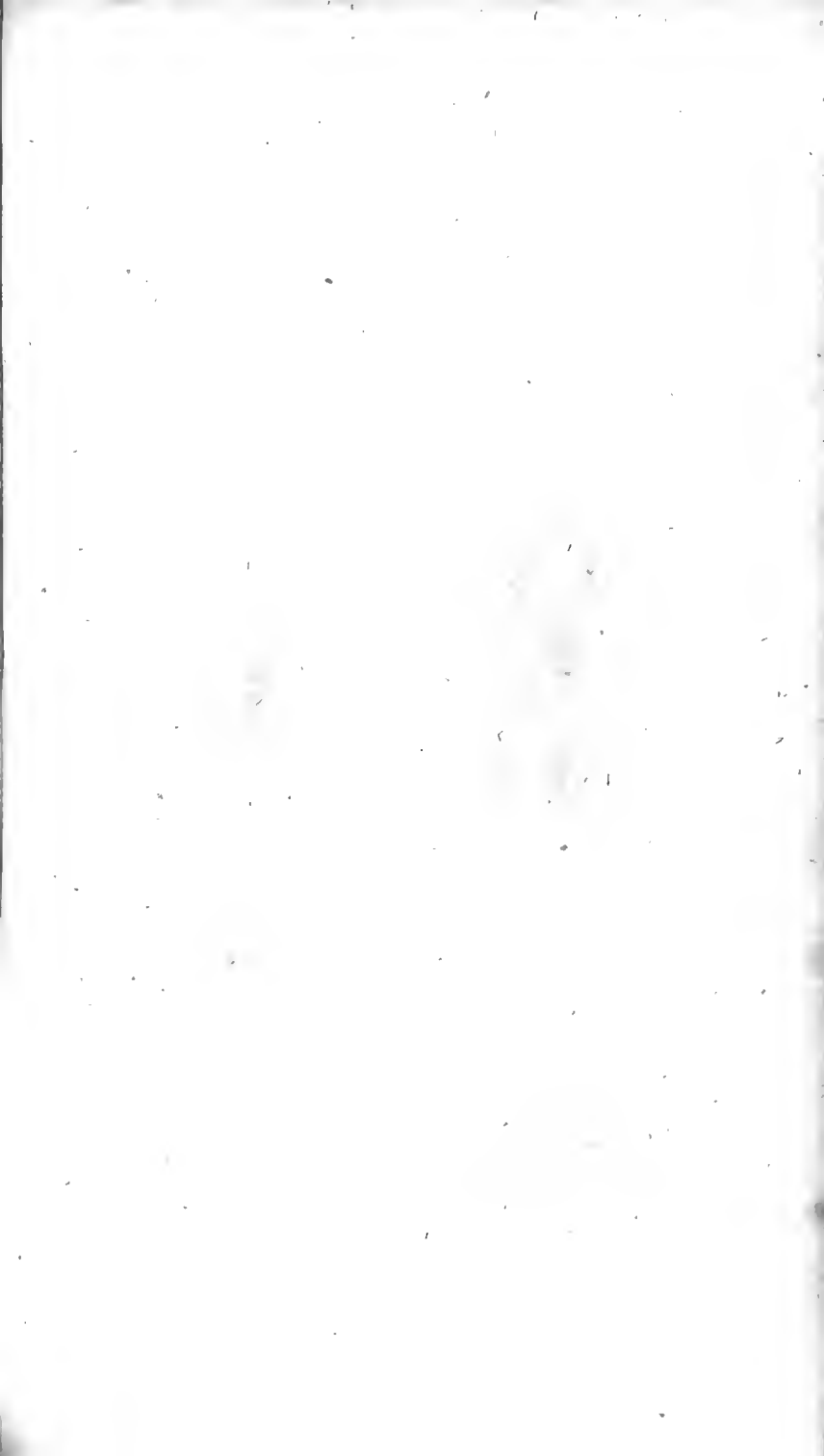
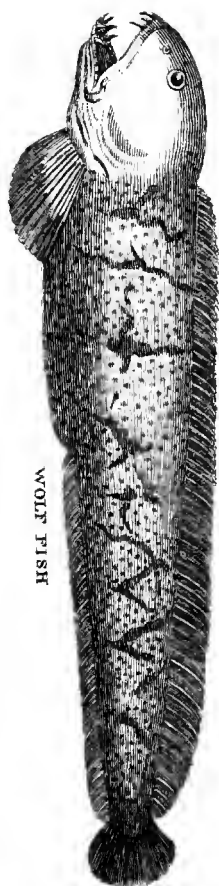
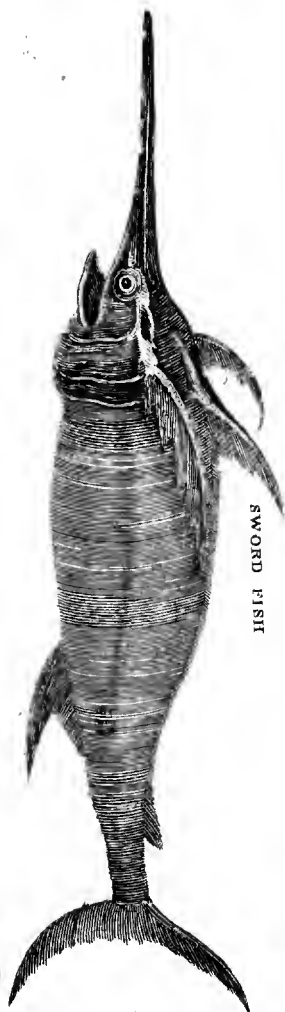


Plate XIII.



GENUS XX.—*The Sword-Fish* *.

OF this genus there is only one species, which on that account is allowed to retain the generic name of sword-fish, an appellation given this animal almost in every country, and evidently derived from the peculiar conformation of the upper jaw; it projects about four times the length of the lower one †, is compressed at the top and bottom, and sharpened towards the point. This enormous snout is three feet long, resembling a sword in shape; its substance is rough and hard, but by no means capable of piercing and sinking vessels in the sea, as is asserted by *Pliny* ‡.

The sword fish grows to a large size, the head alone, being in some instances known to weigh upwards of seventy pounds §. The body is long and slender, thick towards the head, but tapering off into a small size as it approaches the tail: The colour above is black, and on the belly of a silvery white: The mouth is without teeth; the lower jaw terminates like the upper one, in a sharp spear-like point, but is greatly inferior in length: The dorsal fin takes its rise above the gills, and continues till it nearly reaches the tail; it is supported by twenty-six rays; the first of which is by far the strongest and highest, the

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Y

other

* *Xiphias Gladius*, Lin. Syst. L'Heron de Mer. Belon.

† Will. p. 161.

‡ *Rostrum mucronata esse, ab hoc naves perfoctas mergi in oceano*, Lib. 32.

§ Brit. Zool. Class iv. gen. 16.

other gradually diminishing, till the four last, which again rise higher, and give the appearance of a second fin. The tail branches into forks, exactly resembling a crescent: There are on each side, a little above the tail, two triangular protuberances, formed by the skin, resembling the spurious fins of the tunny: the pectoral fins are placed at the gills; the first ray of these is also by far the longest, which gives them the appearance of a scythe. The anus is placed about one third part of the body from the tail, and below it are two anal fins connected by a common membrane. The sword-fish is exceedingly voracious, and is a great enemy of the tunny, which discovers its fear as soon as it approaches. *Ovid* and *Belon* take notice of its hostilities against this timid prey*.

The sword-fish sometimes frequents the *British* seas, but is much more common in the *Mediterranean*; the *Straits of Messina* are particularly famous for it; and it was probably upon a promontory there, that the *speculatores*, or persons employed to watch and give notice of its approach, were stationed. *Willoughby* informs us that he went himself to *Scyllia* to be a spectator of the *Italian* method of killing this animal: The spies above, on seeing the sword, make signals to the boats below, directing the sailors where to steer: As soon as the vessel reaches the spot where the fishes are, one of the most skilful of the fishermen gets upon a mast, erected for the purpose, and directs the boat till it comes within reach of the particular fish at which he intends to aim; he then comes
down

* *Ac durus Xiphias, ictu non mitior ensis;*
Et pavidi magno fugientes agmine Thunni. *Halicut* 97.

down and pierces it with a spear ; this instrument being fastened to a rope, the animal is allowed to struggle till it is overcome with fatigue and pain, when it is either taken up into the vessel, or drawn ashore, according to the size of the fish *.

The flesh of this animal is whiter than that of the tunny, nourishing and not unpleasant in its flavour. The inhabitants of *Sicily* reckon it one of the first delicacies, equal to the sturgeon, and purchase it frequently at the price of sixpence the *English* pound †.

There is another fish nearly allied to the above, which is peculiar to the *American* seas, and called by the *Brazilians* guebucu ‡. The snout is sharp, bony and hard ; its length is sixteen inches, the lower jaw reaching above one half of that space. The length of this species is four feet, and its thickness one ; it is distinguished by two remarkable long bony substances, resembling a rod, in the place of its ventral fins, which it has the power of folding down into a kind of furrow made in the belly for their reception ; the dorsal fin is three feet long, and capable of being hid in the same manner.

* Vide Strabo. Lib. i. apud Will.

† Willough. page 163.

‡ Idem ubi supra.

DIVISION II.—*Jugular Fishes.*GENUS XXI.—*The Dragonet.**

THERE are three kinds of the dragonet enumerated in the system of nature, the *lyra* or gemmeous, the *dracunculus* or sordid, and the *Indian*: They are all destitute of scales; and are of a smooth, uniform body, attenuated towards the tail. The mouth is very small, thickly set with teeth, upon the jaws, tongue and palate †. The eyes are prominent, somewhat large, placed vertically, and near to each other; hence the name of *ouranoscopi*, which these animals have obtained from the old naturalists ‡. The upper lip is in this genus double; and it is also distinguished by a three forked spine, rising from each of the *opercula* of the gills, and lying backwards along the head.

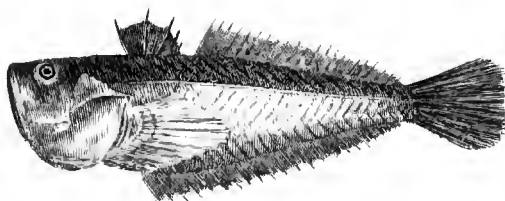
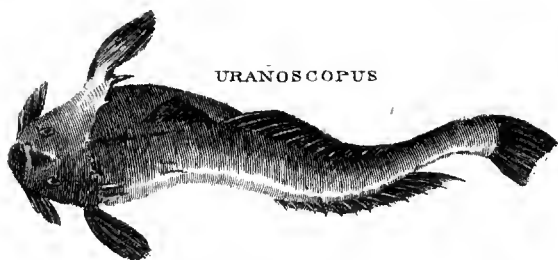
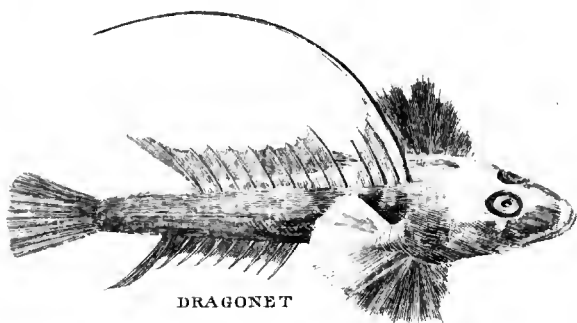
The gemmeous dragonet, is found as far north as *Norway* and *Spitzbergen*, and south as far as the *Mediterranean*: it is not unfrequently upon the *Scarborough* coasts, where it is taken by the hook in thirty or forty fathoms water. It grows to the length of ten or twelve inches, and is
often

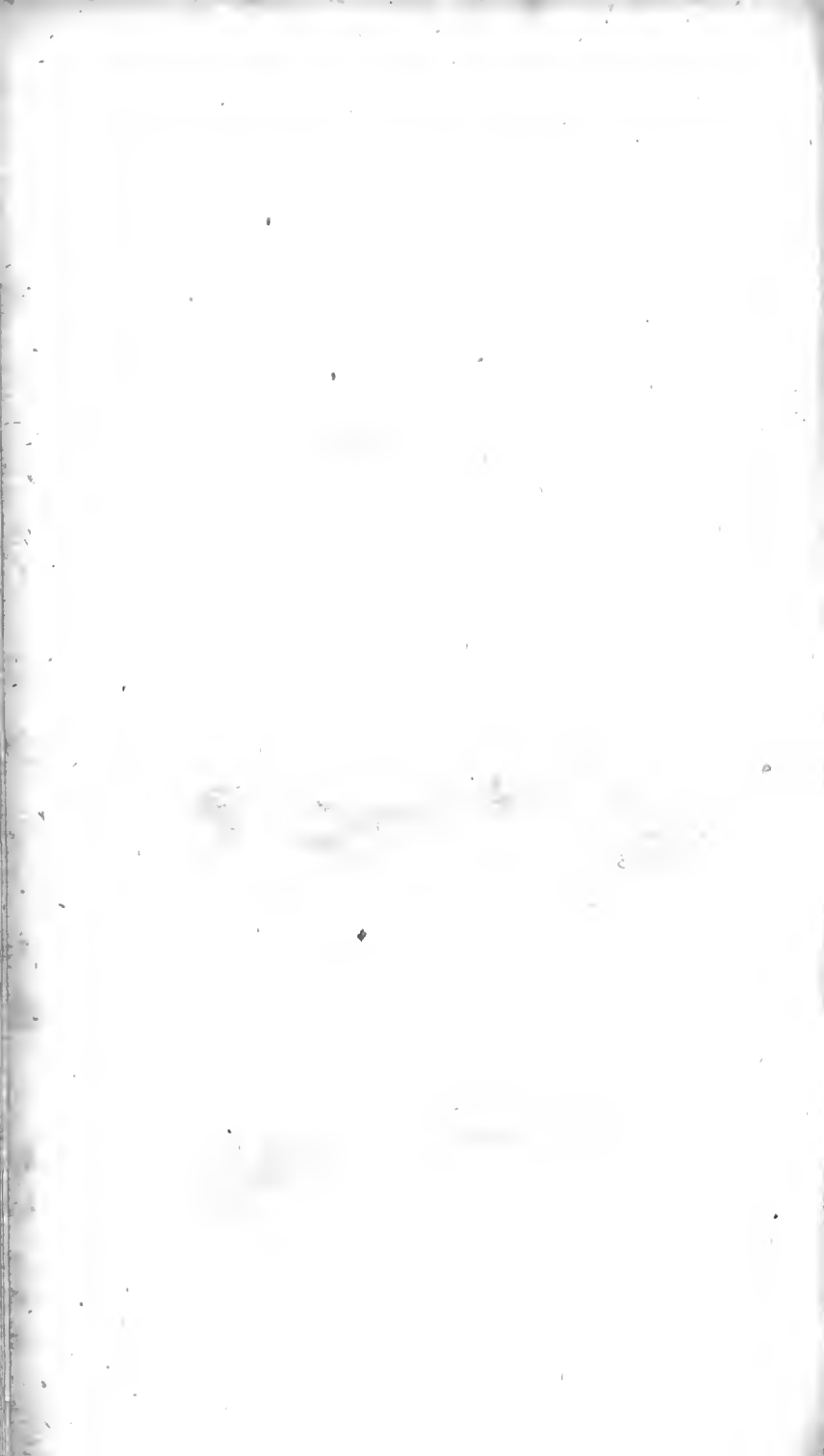
* *Callionymus Lyra*, Lin. Syst. Yellow Gurnard, Phil. Transf. No. 292.

† Guat. Hist. Pisc. 121.

‡ *Vide Gronov. Zooph. No. 206.*

Plate XIV.





often found in the stomach of the cod-fish. It breathes in the manner of the cetaceous fishes, by means of two orifices in the crown of the head, through which it forces the water received by the mouth *.

The ventral fins are jugular, and placed before the pectoral, a circumstance by which all the fish of this division are distinguished; they are placed at a distance from each other, are broad, and of one piece. The pectoral fins are round, of a light brown colour, the rays aculeated, and extending beyond the membrane that connects them like lances. The dorsal fins are two; the first of a form so singular, that it at once distinguishes this species from every other. The first ray is cetaceous, and extends in a curved direction, almost as far as the tail. The rays of the second dorsal fin are of an equal length, except the last, which extends a considerable way beyond the rest: The anal fin is placed exactly opposite to it, and resembles it very nearly, both in shape and size.

The tail of this species is long, rounded, and supported by ten rays. It has obtained the name of the gemmeous dragonet, from the variety and brilliancy of its colours: When taken out of the water, the yellow, the white, and rich cærulean blue, with which it sparkles, make a fine appearance; the last colour in particular glows with inexpressible splendour.

The sordid dragonet is inferior in size, as well as beauty; being only about six inches in length; and about two in thickness. It is of an olive colour above, and white below, The sides are marbled with small spots of silvery

* Brit. Zool. class iv. gen. 17.

silvery blue ; and upon the top of the head is a triangular spot of a purplish colour. It frequents the *British* seas but rarely ; *Willoughby*, however, asserts that it is frequently seen in the fish markets of *Rome* and *Genoa* : Its flesh resembles that of the bull-head, and its manner of feeding is the same.

GENUS XXII. *The Uranoscopus* *.

OF this genus there is but one species, a fish about nine inches in length, with a large, flat, and circular head. The lower jaw projects beyond the upper, and is turned upwards at the end; the eyes are small, prominent, and almost contiguous. The face is flat, and has the appearance of constantly staring upwards. Both the jaws are armed with sharp teeth, as is also the palate and whole inside of the mouth. The whole face, but particularly the covers of the gills, are rough and unequal with tubercles, the bases of which are surrounded with spines; and at the extremity of each of the opercula, where the head unites with the body, there are two pointing backwards, remarkably sharp and large. The uranoscopus has two dorsal fins; that nearest the head is small, of a black colour, and supported by three sharp rays: The second is higher and broader, and contains fourteen rays: The ventral fins in this species are placed far before the pectoral, and seem directly under the eyes: It is frequently caught in the *Mediterranean*, and is said to be a delicious morsel †.

* Trachinus, Artedi Uranoscopus. Aldrov.

† Gesner de piscib.

GENUS XXIII. *The Weever* *.

THERE are several species of this genus found on the *British* coasts, although *Linnaeus* only mentions one, the draco, a fish of along and compressed figure, marked upon the sides by a number of cinereous lines, that arise from the middle of the back, and proceed along the sides towards the belly. The two lateral lines that extend from the gills to the tail, are placed much nearer the back than those of any other fish. The *branchiae* are yellow, the belly white, and the whole body is covered with small thin scales. The eyes are placed remarkably near to the snout; the irides are yellow, punctuated with black spots. The lower jaw projects beyond the upper; both armed with small teeth. The apertures of the gills are uncommonly large, and each of the covers is furnished upon the upper angle, with a strong sharp spine. The dorsal fins are two; the first consisting of five sharp prickly rays; the second is supported only by cartilaginous rays, and is prolonged almost to the tail. The pectoral fins are situated lower than usual; the ventral fins are jugular, each strengthened by six rays. The anus is not far from the throat; and from it to the tail, there proceeds a long fin fortified by thirty-two rays, which project beyond the membrane that connects them †.

The

* *Trachinus Draco*, Lin. Syst. *Draco Marinus*, Plinii.† *Vide* Willough. page 288.

The weever is frequent in the *Mediterranean*, where it grows from ten to fifteen feet in length; it is capable of inflicting a very severe wound by the spines of the first dorsal fin, which, if neglected, becomes cancerous, according to *Rondeletius* *. For several hours, the part affected is attended with a violent burning, and shooting pain, sometimes with an inflammation, that reaches from the arm to the shoulder. These effects are commonly supposed to proceed from something venomous, lodged in the spines, which look indeed suspicious; for those of the first dorsal fin are dyed with a blackish substance. Various remedies are applied to relieve the pain of this wound. *Rondeletius* recommends the flesh or brains of the animal; our fishermen rub the parts affected with sea sand; while those of *Scarborough* successfully use stale urine, applied warm.

This animal is excellent food, and therefore is often taken, notwithstanding the noxious quality of the spines: it buries itself in the sand, leaving only its nose out; and if trodden on, immediately strikes with great force, each blow directed with a degree of judgment that evinces a consciousness in the animal of its own noxious powers †. *Willoughby* describes three species belonging to this genus; the first is the fish above described; the second a larger kind, seen at *Rome*, with beautiful variegated colours; and the third a *Brazilian* fish, called *niqui* by the natives.

* De piscibus, 300.

† Brit. Zool. class iv. genus 18.

GENUS XXII. *The Cod* *.

THIS genus contains a very numerous, and well known tribe of fishes, a considerable part of which frequent the *British* coasts, and contribute more largely to the subsistence of the inhabitants of *Europe*, than any of those families which we have hitherto reviewed. Their general characters are, a smooth head ; seven slender branchiostegous rays ; an oblong body, covered with small deciduous scales. The number and situation of the fins are various ; the teeth are small, and numerous, placed upon each jaw, and in the upper part of the mouth †.

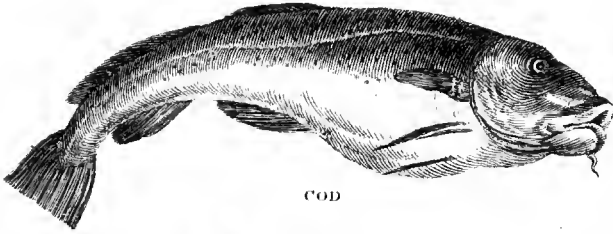
The stated migrations of most of the fish that compose this genus, is one of the most remarkable circumstances in their history : in these annual voyages, in the immensity of their numbers, and in their social habits, they bear a strong analogy to birds of passage. The cod, the haddock, and the whiting, issue forth in immense shoals from the arctic seas, very early in the spring, and after having dispersed over the temperate latitudes, again regularly return to their northern retreats about the same time of the year. The necessity of procuring food has been assigned as the cause of their annual migrations from the arctic seas ; and their retreat thither has been ascribed to the security that these unfrequented tracts are supposed to afford them, while they deposite their spawn.

But

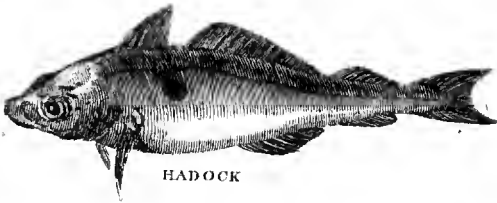
* *Afellus Major Vulgaris*, Willough. *Gadus Morhua*, Lin. Syst.

† *British Zool. class iv. gen. 19.*

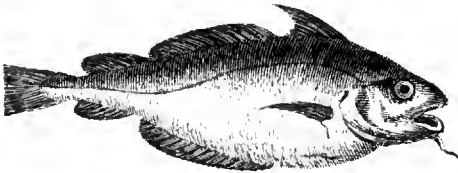
Plate XV.



COD



HADOCK



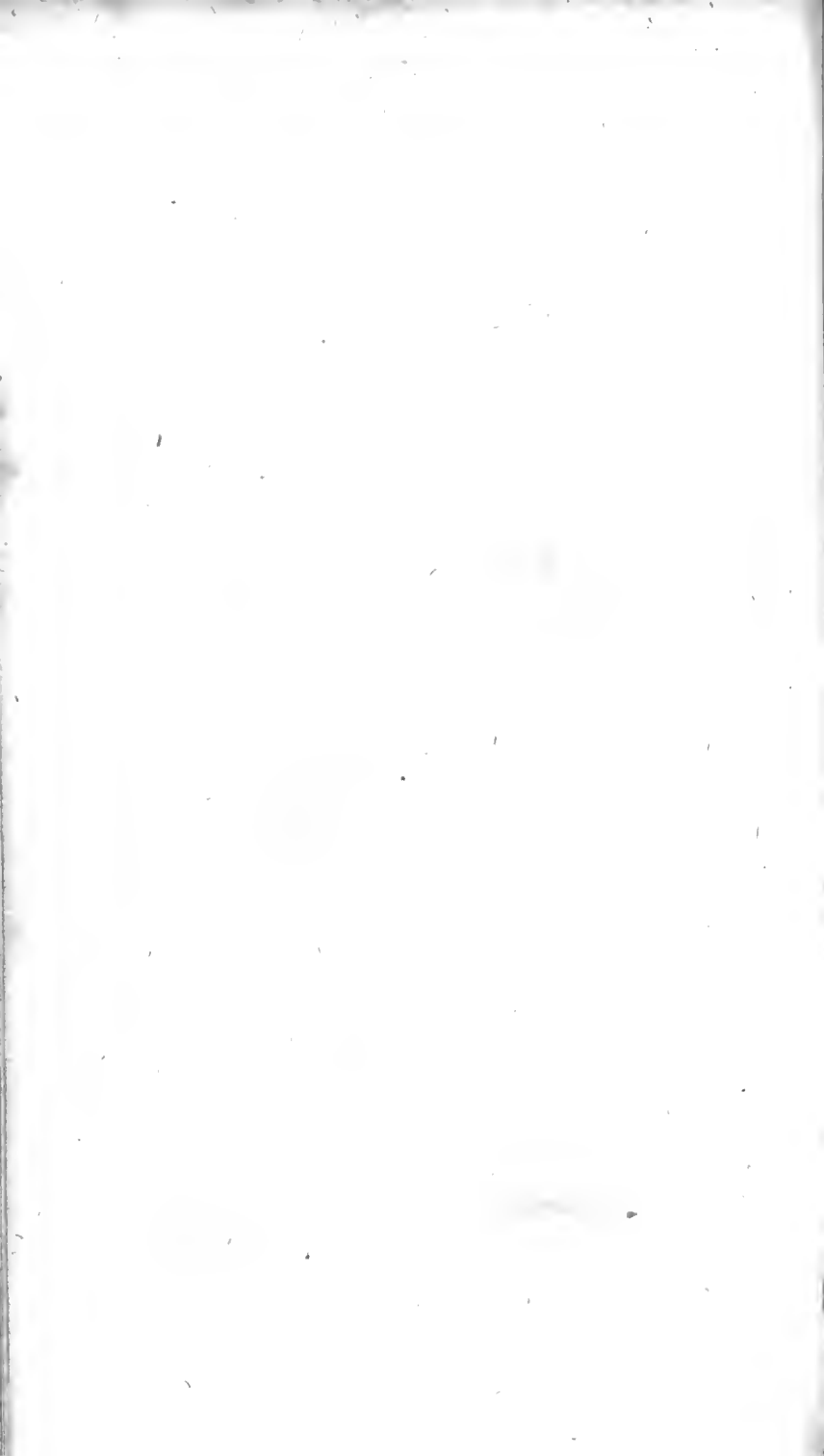
WHITING POUT



WHITING



LING



But although the cod undertakes annual excursions of considerable length, it still may be regarded as a local fish; for it never ventures into the warmer tracks of the ocean. None are found in the *Mediterranean* *; and few in those parts of the *Atlantic* of the same latitude. They are in greatest perfection, and seem to prefer that space lying between the fiftieth and sixtieth degrees; such as are caught beyond it, being always inferior, both in quantity and quality †. Their grand resort for centuries past, has been on the banks of *Newfoundland*, and other sand banks off *Cape Breton*. That extensive flat seems to be the broad top of a subaqueous mountain, every where surrounded with a deeper sea. Hither the cod annually repair, in numbers beyond the power of calculation, to feed upon the worms that swarm upon the sandy bottom. Here they are taken in such quantities, that they supply all *Europe* with a considerable quantity of provision. The *English* have stages erected all along the shore, for salting and drying them; and the fishermen, who take them with the hook and line, draw them as fast as they can throw them out ‡.

This immense capture makes no sensible diminution of their numbers; for after their food is consumed in these parts, or when the season of propagation approaches, they take their departure for the polar seas, where they deposit their roes in full security, and repair the waste which has been occasioned by death, or the depredations of their enemies. They annually make their appearance on the coasts of *Iceland*, *Norway*, and *Britain*, gradually diminishing in their numbers, as they proceed to the

Z 2

south,

* Rondeletius de piscibus.

† British Zool. ubi supra.

‡ Goldsmith's Nat. Hist. vol. vi. page 325.

south, and ceasing altogether before they advance to the straits of *Gibraltar* *.

Before the discovery of *Newfoundland*, the greatest fisheries of the cod were on the coasts of *Iceland*, and the western isles of *Scotland*, where the *English* resorted in quest of them, as early as the beginning of the fifteenth century. Our right of fishing in these parts, however, was not acknowledged by the government of *Denmark* †, till the reign of *James I.* whose marriage with a princess of that country, secured to his subjects that indulgence of which they availed themselves so completely, that they had then a hundred and fifty ships employed in the *Iceland* fishery.

Even on the banks of *Newfoundland*, the *French*, *Spaniards*, and *Portuguese*, had originally a far larger portion of the fishing, than the *British*: In 1570, the former nations had upwards of three hundred vessels employed in that trade, when those of the *English* did not exceed fifty ‡. Matters, however, have since been reversed; and the *English* shipping on that coast has immensely increased; it is now superior to that of any other nation, and the trade is deemed a valuable accession to the wealth of individuals, as well as to the naval power of the empire §.

This immense fishery is conducted in a tract of the sea, agitated by a perpetual swell, and involved in continual darkness, by means of a thick fog, that constantly hangs
over

* *British Zool.*

† *Rymer's fœd.* xvi. 275.

‡ *Hackluyt's coll.* voy. iii. 132.

§ 15000 *British* seamen are at present employed in this fishery. *British Zoology.*

over it: The bait used is herring, a small fish called *capelin*, a shell fish, and bits of sea fowl. The natural food of the cod is small fish, testaceous animals, such as crabs and whelks; and their digestive powers are so strong, that they dissolve every substance which a voracity almost indiscriminate, leads them to devour. Their sight is probably very imperfect; for almost every small body that is agitated by the water, attracts their rapacity, stones and pebbles not excepted, for these are often found in their stomachs.

The sounds of the cod fish, are reckoned a great delicacy, and frequently brought from *Newfoundland*, salted up by themselves: They are employed by the fishermen of *Iceland*, in making isinglass; are obtained, by carefully separating them from the back-bone, to which they adhere after the fish is cut up*.

The general weight of the cod fish on the *British* coasts is from fourteen to forty pounds; some have indeed been caught near eighty, but those of the middle size are most esteemed for the table. Their time of spawning is from January to April, when they deposit their eggs in rough rocky ground. After having been exonerated of a load containing frequently three millions of young, the parent recovers its plumpness sooner than almost any other fish; and is caught in good condition, during almost the whole summer.

Schonfeldt remarks a kind appointment of providence in the immense fecundity of this fish, and in that abundant supply which it affords to the inhabitants of those
bleak

* Phil. Trans. 1773.

† *Vide* Schon. apud Willough. page 166.

bleak and frozen countries, that are unfit for the production of grain. The ichthyophagi of these barren regions, says he, not only furnish themselves with a substitute for bread, by drying this fish, but send a vast quantity of their surplus stores to add to the supply of other nations *. The numbers and fertility of these fish, seem indeed amply to justify the grateful exultations of this writer; for they are such as will forever baffle all the efforts of man, and the voracity of the inhabitants of the ocean, to exterminate their race; and will secure to every age an inexhaustible supply of wholesome provision.

The cod is a fish so well known, that it requires not any particular description; the colour, which is commonly finereous, and spotted with yellow on the back and sides, varies much according to the age and residence of the animal.

The Hadock †.

THIS species appears upon the coasts of *Britain* annually, particularly those of *Yorkshire*, about the middle of December, and in such vast shoals, that they cover a tract frequently of many miles. They do not venture far from the shore; when the fishermen cast their lines beyond their limits, which is commonly about three miles
from

* *Vide* Schonf. apud Willough. page 166.

† *Gadus Æglefinus*. Lin. Syst. Tertia ællorum species.

from land, they are seldom any taken. The larger haddocks leave the coast as soon as they begin to be out of season, leaving behind only the smaller fish. This remark is applicable to all the fish that appear on the *Yorkshire* coast, except the mackerel, which alone remains after becoming unfit for use *.

The haddock is the most common species in the *London* market, as it is not only plenty, but in season during the greatest part of the year. The larger fish begin to roe in the middle of November, and continue so till the end of January, when they are unfit for use. Those of the middle size recover about the beginning of May, and are in season till February; such as are incapable of breeding remain at all times fit for the table. In stormy weather none of this species take the bait; the fishermen assert, that they then ooze in the bottom of the sea, and shelter themselves there, till the agitation of the water has ceased: In proof of this, they allege that those which are taken immediately after a storm, are covered with mud upon the back.

The common size of the haddock is twelve inches in length, of a dark colour upon the back, and the skin covered with small scales. On each side about the middle is a large black spot, the prints, as it is said, of the finger and thumb of *St. Peter*, when he held this species, and took the tribute out of its mouth: A mark which superstition has extended to the whole race of haddocks, at once to attest and commemorate that miracle; unfortunately, however, the haddock is not the only fish that has been supposed to be thus distinguished by the marks of the apostolic touch †.

Of

* British Zoology.

† Willough. page 170.

Of the same genus, but inferior in size, are the pouts, blinds, and poors. The latter is the smallest of the cod kind yet discovered; and it is the only one found in the *Mediterranean*. It is taken near *Marseilles*, and in such quantities as sometimes to prove a nuisance. It seldom exceeds six inches in length, and is unfit either for being dried or salted; if the first is attempted, it grows as hard as an horn*. The whiting is the most delicate and wholesome food of any of this genus: It appears in vast shoals on our coasts in spring, and is caught with the line, from one to three miles from the land.

The Coal-Fish †.

ALL the species of the cod, which we have mentioned, are distinguished by a barb under the lower jaw; in the coal fish this is wanting. It is of a dark cerulean blue, and has from that circumstance obtained its *English* name. The eyes are large and protuberant, and the upper jaw, which in the common cod projects beyond the lower, in this species is the shortest of the two ‡.

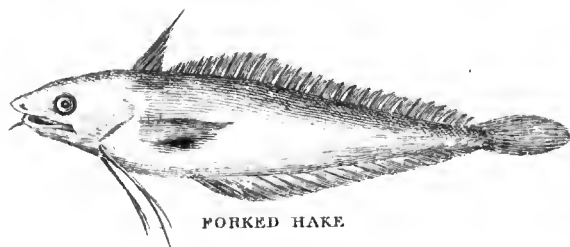
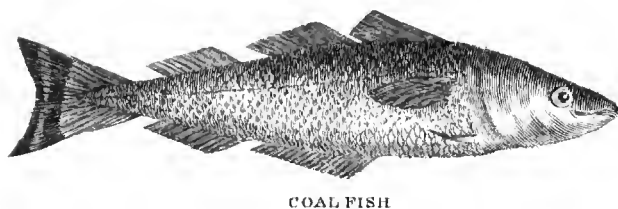
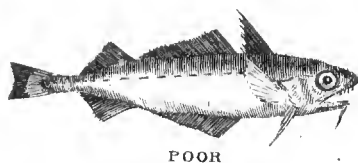
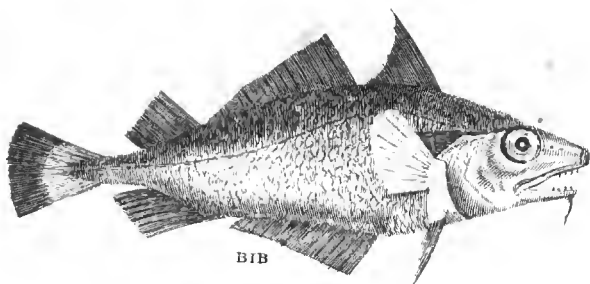
The coal fish frequent the rocky and deep coasts all round this island, but are found in greatest plenty in the vicinity of the *Orkneys*, where their fry constitute a
great

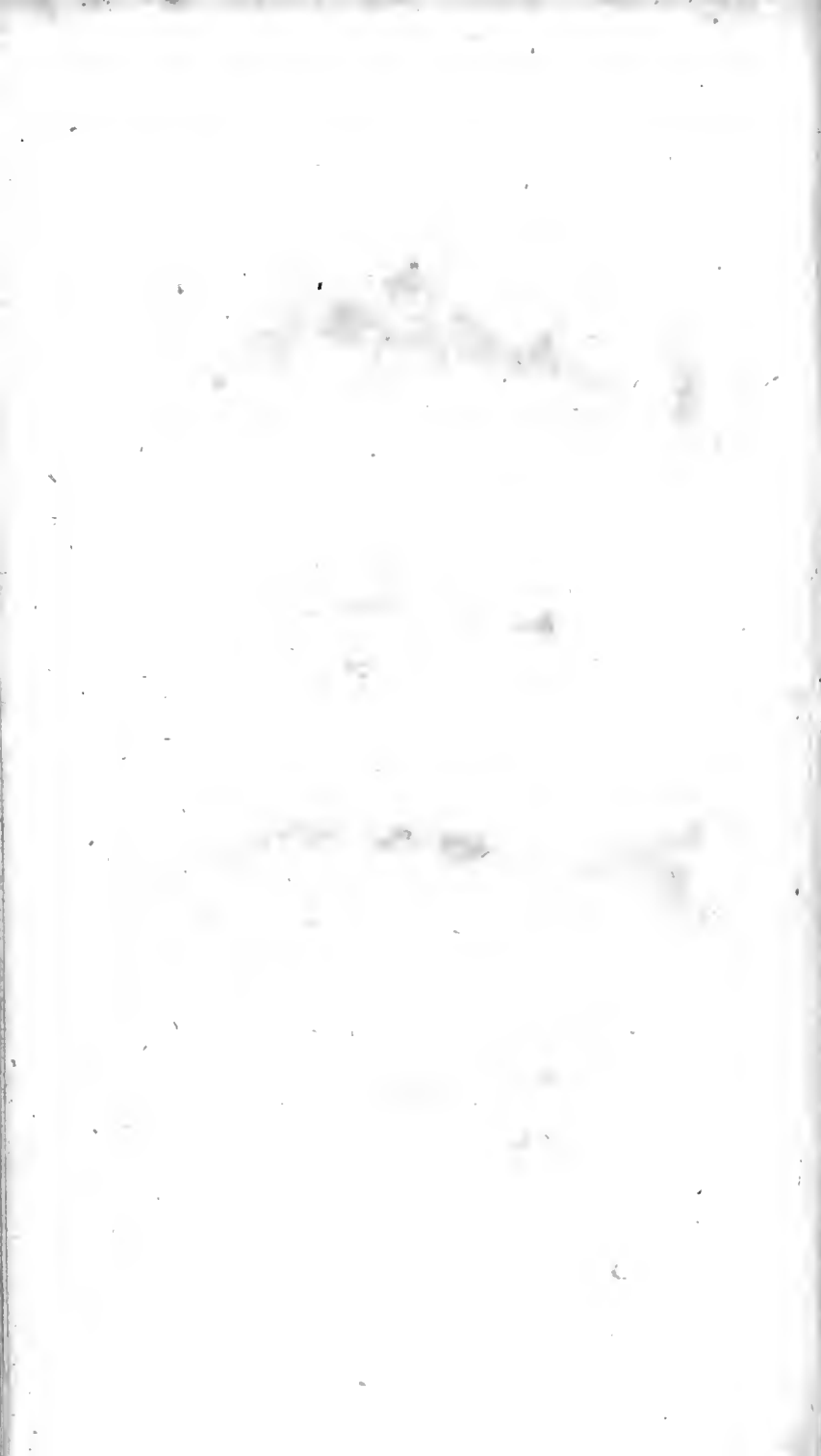
* Belon de piscibus, p. 120.

† Colfisch Anglorum, Gesn. *Gadus Carbonarius*, Lin. Syst.

‡ Will. p. 168.

Plate XVI





great part of the support of the poor. The young begin to appear on the coast of *Yorkshire*, in the month of July, in numbers that defy all computation : They are at that period only an inch and a half long ; in August they are from three to five inches, and are taken in vast quantities with the angling rod ; they are then reckoned a very delicate dish, but afterwards grow so coarse, that, by the time they are a year old, few people eat them*. They are sold either fresh, or when salted, in the counties of *York* and *Northumberland*, at an inferior price to the other species of cod.

The Hake †.

THIS species has only two dorsal fins ; grows from two to three feet in length, and is of a more slender shape than the common cod. Its form somewhat resembles that of the pike ; whence it is called the sea pike by the *French* and *Italians* ‡. The mouth is large, and furnished with a mixture of short and long teeth ; and the palate, as is common to the fishes of this genus, is beset with sharp spines or teeth. The first dorsal fin has nine rays ; the second, which extends almost to the tail, has forty ; the pectoral fins are furnished each with twelve rays ; and the ventral, which are situated before, are supported by seven cartila-

VOL. III.

A a

ges ;

* Vide Schon. apud Will. p. 169.

† *Astellus primus*. Will. *Gadus Merluccius*, Lin. Syst.

‡ *Merluccius*, Vide Gessner and Will.

ges ; the tail is not forked, but each ray being equally produced, terminates in the same straight line.

The hake is found in abundance on many of our coasts ; particularly those of *Ireland*, where there was formerly a stated fishery on the *Nymph Bank* off *Waterford* ; immense quantities were caught there at the two seasons of their periodical appearance, June and September, when six men with hooks and lines frequently killed a thousand fish in one night ; the produce of this fishery was salted up and exported to *Bilboa* in *Spain* ; it has, however, been for many years upon the decline, owing to the fish deserting their wonted station *.

This dereliction of their accustomed haunts, is not peculiar to the fishes of this species ; the haddock has in the same manner abandoned the coasts of *Waterford*, and the herrings and the basking sharks have displayed the same caprice, in relinquishing their stations on several parts of the *British* shores. Naturalists have not yet given any plausible account of this irregularity in the migration of fishes : In some instances it may be occasioned by the close pursuit of an unusual number of predatory fish, to avoid whose voracity they may be driven upon shores that they were formerly unaccustomed to frequent ; a deficiency of the smaller fish, that supplied them, may, in other instances, have forced them to abandon a residence, where they could no longer be supported : But the pernicious custom of trawling, is perhaps the most common cause of their abandoning the usual stations, because, by that means, not only a great part of their spawn is demolished, which was lodged in the sand, but the worms and
insects

* Smith's Hist. of *Waterford*, p. 261.

insects which constituted their food, are either destroyed by it, or driven into deeper water *.

There are three varieties of the hake found in our seas, besides that above described; the greater and lesser forked hake, and the three forked species: The last, *Linnaeus* has omitted in the System of Nature; and the two former he has placed among the blennies. The bifurcated hake is about twelve inches in length; the colour a deep brown, excepting the colour of the lips, which are snow white; these surrounding a broad flat snout, give the animal a strange appearance, sufficiently characteristic of the species.

The Ling†.

THIS species is longer than the river pike, being from four to six feet; the sides and back in some are olive-coloured, in others cinereous; and the whole figure of the body nearly resembles that of the fish last described: the upper jaw projects beyond the lower, both being exasperated with several rows of short teeth; the palate is armed in the same manner, with parallel rows of small teeth, here and there interspersed with a few of superior size, strength, and sharpness; the mouth and tongue are large; from the corner of the lower jaw there hangs a single

A 2 2

barb

* Brit. Zool. Class iv. gen. 19.

† *Asellus longus*, Will. *Gadus molva*, Lin. Syst.

barb about two inches long; upon the back are two dorsal fins, the first consisting of fifteen, and the second of sixty-five rays, extending like the anal fin, opposite nearly to the tail; the pectoral fins are each supported by fifteen cartilaginous rays, and the ventral by six; the three first projecting beyond the connecting membrane, terminate like spines*.

The ling abounds more or less upon the coasts all round the *British* isles; it is, however, most frequent near *Scilly* isles, and those on the west of *Scotland* and *Ireland*, where it has long formed a considerable branch of commerce, regulations being framed concerning it so early as the reign of *Edward III*†. The fish is in perfection from the beginning of February till May; in June they deposit their spawn in the soft, muddy bottoms near the mouths of rivers; about this time the males separate from the females, many of the former being caught by fishermen, without a single individual of the latter.

When the ling is in season, its liver is white, and abounds with an oil of an excellent quality and flavour; but as soon as the fish becomes out of season, the liver gradually assumes a red colour, resembling that of an ox, and it then produces no oil: The same change of colour of the liver is observable in cod, and several other fishes, but not in a degree so remarkable. It would seem, that this oil which is lodged in the cellular membranes of fishes, returns into their blood, and supports them during the period of procreation; a season in which they pursue the work of generation with so much eagerness, that they neglect their food.

As

* Will. p. 175.

† Brit. Zool. Class iv. gen. 19.

As the oil of this species can only be obtained while the animal is in season, so it can be extracted from the liver only by a slow fire; if a violent heat be applied in melting it, a very small quantity will be had from the fish, even in its greatest perfection. Such fish as are cured for exportation, must measure a certain length from the shoulder to the tail, otherwise they are not entitled to the bounty which parliament has granted for the encouragement of this trade; twenty-six inches is the length of a sizeable fish; those of inferior dimensions are called drizzles, and because incapable of procreation, they continue in season during the whole summer*.

There is a fresh water fish that somewhat resembles the ling, called the burbot, or eel-pout†: it abounds in the lake of *Geneva*, where it is called *lota*, and is found also in several of the rivers in the north of *England*. The body is smooth, soft, and lubricated like that of the eel; the number and disposition of fins, resembles that of the ling: The season of generation in this species is December; at which period, though the body is small, one hundred and twenty-eight thousand ova have been taken from a single female, each of which is capable of becoming a fish, after fecundation by the male.

* Brit. Zool. ubi supra.

† Will. p. 125.

The Five-Bearded Cod.*

THE colour of this is a deep olive brown; in its shape and slimy covering it somewhat resembles the eel; it is, however, much shorter and thicker, especially towards the belly: There are two different species, the one with five beards, and the other uniformly with three; the former has four upon the upper jaw the latter only two. From the extremity of the lower jaw in both, there hangs a beard: The scales of both kinds are extremely minute; each has the same number of fins, and in the same position; they are distinguished by the shape of the two dorsal fins; the first rises a little way behind the head, where it is lodged in a deep furrow, and consists of a number of short unconnected rays, or filaments; behind this furrow, in the middle of the back, rises the second dorsal fin, considerably higher than the first, and extending almost to the tail, which is rounded at the extremity; this fin is supported by fifty-six rays, and the anal one, opposite to it, by forty-seven. This species grows to the length of nineteen inches, and weighs upwards of two pounds.

The three-bearded cod is nearly of the same size with the other, of which *Willoughby* reckons it only a variety; it is, however, easily distinguishable, by having the upper part of the body variegated by a number of black spots upon a reddish ground. The *Cornish* fishermen have

* *Mustela vulgaris*, Rond. Sea-Loach, Will.

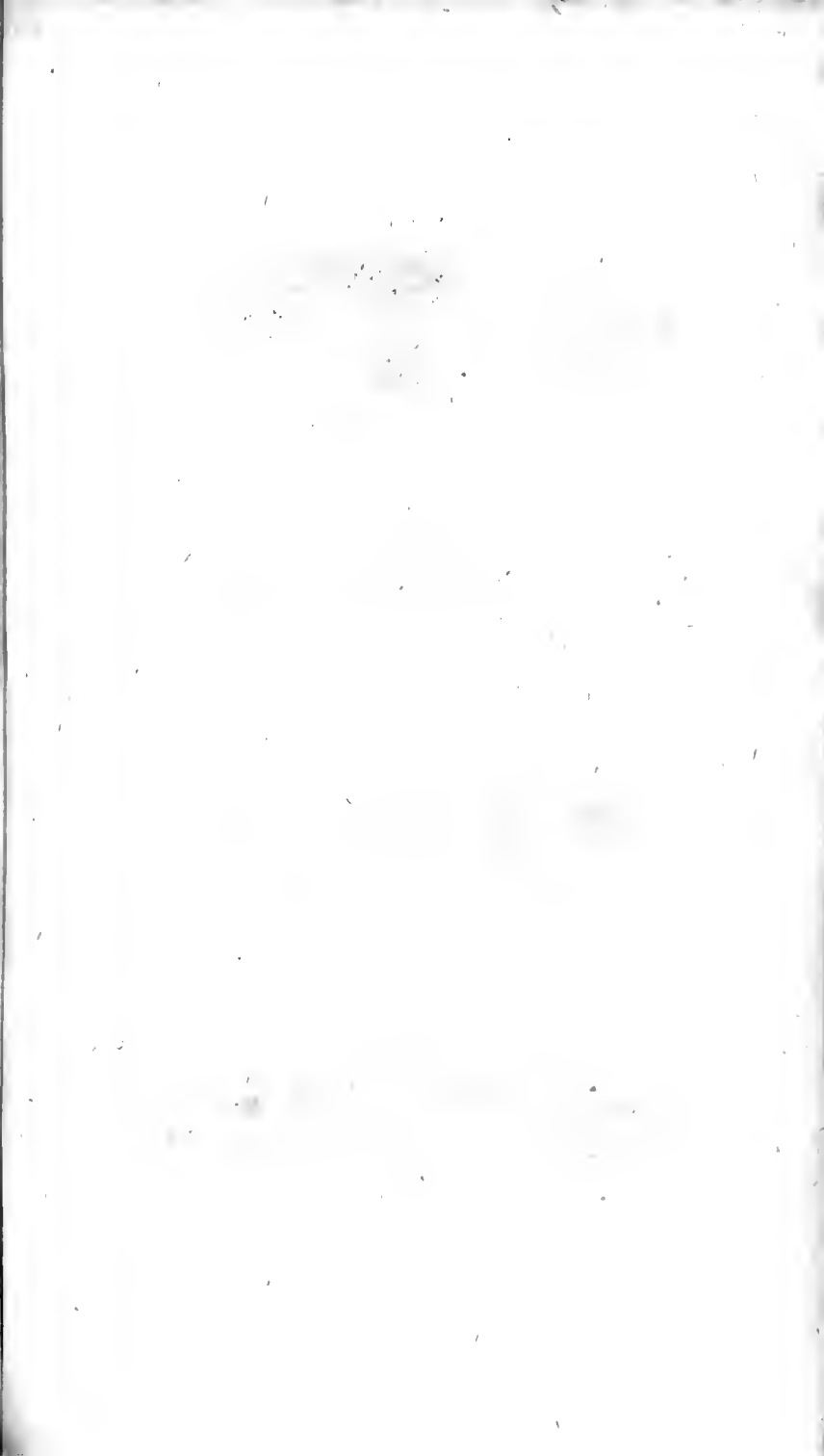
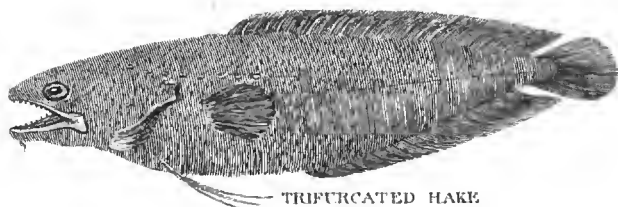
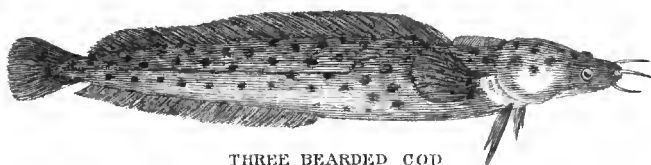


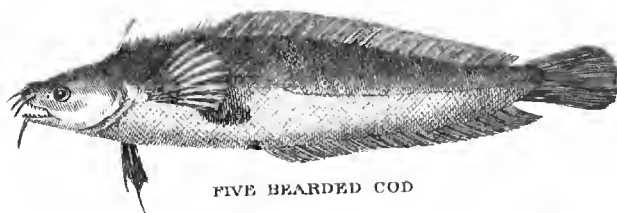
Plate XVII



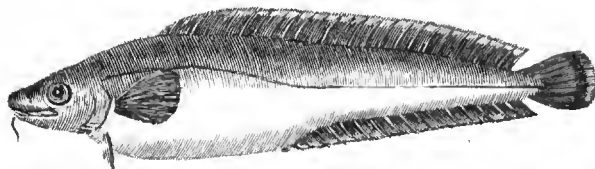
TRIFURCATED HAKE



THREE BEARDED COD



FIVE BEARDED COD



TORSK

have particular cant phrases, by which they imagine they charm these fishes, which they repeat in the same manner that the *Sicilians* do their *mamassu di pajanu*, &c. when they are in pursuit of the sword-fish *.

The Torfk.

WE have already seen the fishes of this genus, possessing, some three, others two dorsal fins; the fish now under observation is an inhabitant of the *Orkney* seas; and from having only one dorsal fin, forms a class distinct from both. It is called by the inhabitants of *Orkney* and *Shetland*, tusk or brislae; and is seldom found in a lower latitude than that of these islands, where it swarms in great abundance, and is either dried or barrellled up for exportation.

The torfk grows commonly to the length of twenty inches, and to the depth of four; the head is small, the upper jaw projecting beyond the lower, and both armed with a multitude of small teeth. The fish known in *Sweden* by the same name, is described by *Linnaeus* with three dorsal fins; that of the *Orkneys*, however, has only one rising about six inches behind the snout, and extending nearly to the tail; opposite to it is the anal fin, commencing at the anus, and reaching the same length; the rays

* Brit. Zool.

rays of each are but indistinctly perceived, on account of the thickness of the membrane that covers them.

From the extremity of the lower jaw there hangs a single beard; the colour of the head is dusky, that of the sides and back is yellow, and of the belly white; the pectoral fins are brown; the dorsal, caudal, and anal fins, are dusky, surrounded by a white margin.

SECTION V.

GENUS XXV.—*The Blenny.*

THE generic characters of this tribe, are, a short, blunt snout, a smooth body, covered with a glutinous substance, and compressed laterally. The teeth are slender, and the ventral fins small, supported only by two connected rays. The dorsal fin begins a little behind the head, and reaches the whole length of the back. The fishes of this genus are variously classed by naturalists, some of them being mingled with those of the last, while others are classed with the sea scorpions, and other heterogeneous tribes. *Linnaeus* enumerates thirteen different species of the blenny, only four or five of which are known to frequent our coasts; the gattorugine, the crested, the smooth-headed, the spotted, and viviparous blenny; all these haunt the rocky shores, and at low water are found under the stones among the tang. They are extremely active and vivacious; by means of their ventral fins they can creep among the rocks; and some species can live out of the water during the length of a whole day.

The Gattorugine.*

THE species has been found on the coast of *Wales*; the body is without scales, and lubricated with a slimy substance. Towards the head it is thick, gradually diminishing towards the tail; the sides all along considerably compressed. It is above of a dusky hue, marked across with undulating lines; below of a pale ash colour, the ventral and pectoral fins partly orange. The rays of all the fins of this species project beyond their webs, and have a spiny appearance. The eyes are situated almost upon the summit of the head, contiguous, and extremely protuberant; between them arises a kind of crest, which separates into four branches, and which can be raised or depressed by the animal at pleasure. The *cirri* forming this crest are thick at the base, sharpening towards the top, and setaceous along the sides †.

Similar to the gattorugine, is the crested blenny, a fish distinguished by the same crest-like fin upon the top of the head. Its residence is the same; for it is always found on the rocky shores, where it probably feeds on crabs and small shell-fish; the remains of those animals being found in its stomach ‡.

The smooth blenny resembles the crested, almost in every respect, except that of the smoothness of its forehead, which is destitute of that erect fin, the use of which no naturalist has hitherto pointed out.

* *Gattorugine Vincetis*, Will. *Blennius Gattorugine*, Lin. Syst.

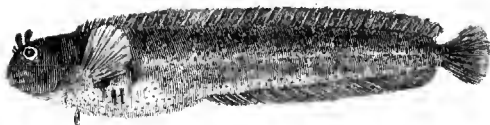
† Vid. Willough. p. 132.

‡ Brit. Zool.

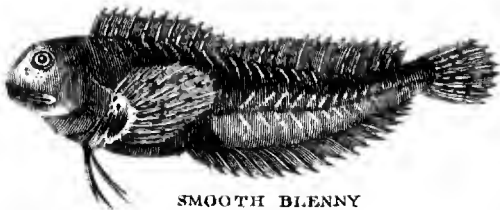
Plate XVIII.



CATTORUGINE



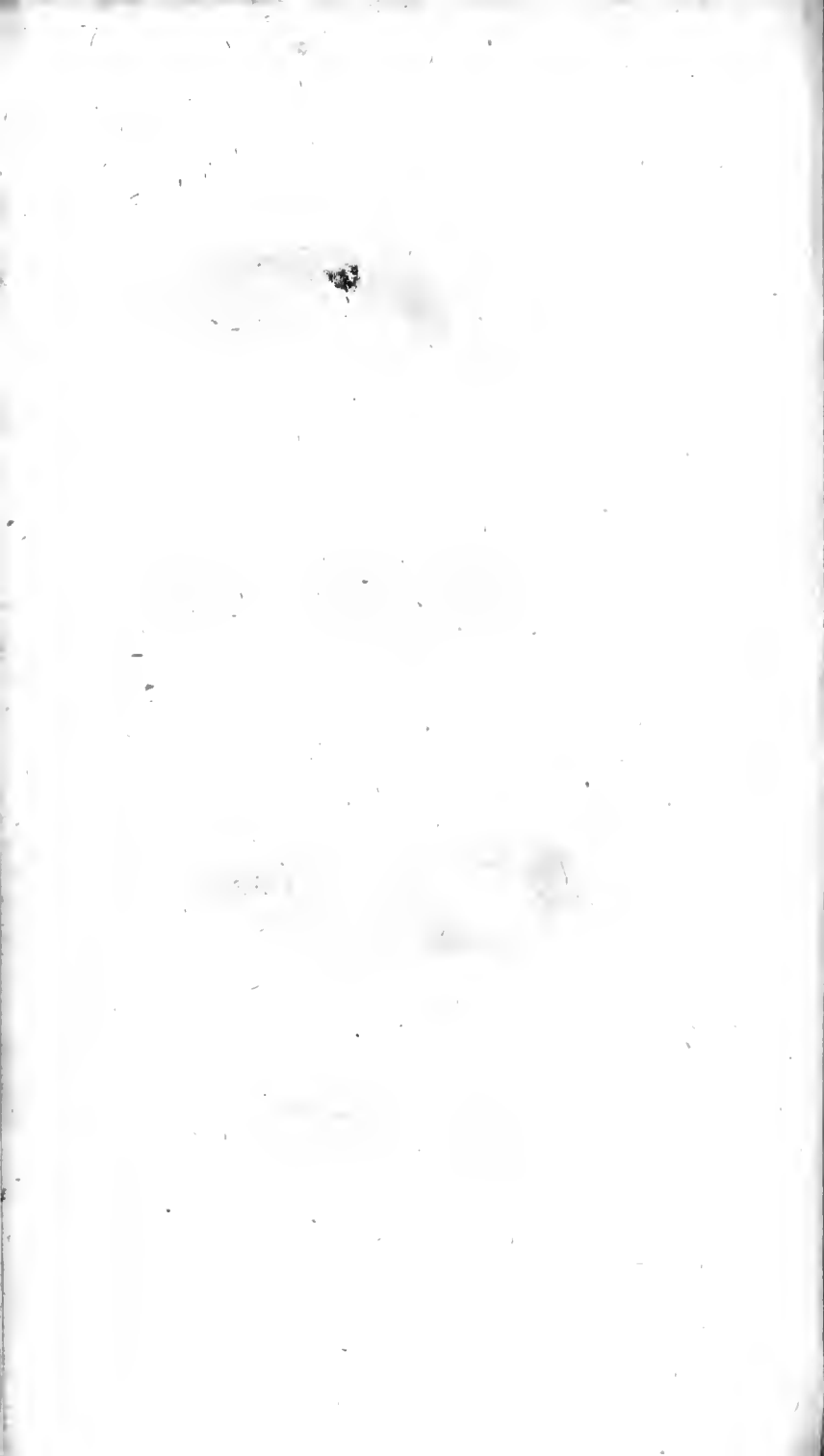
CRESTED BLENNY



SMOOTH BLENNY



VIVIPAROUS BLENNY



The Viviparous Blenny *.

THE viviparous blenny in its mode of generation, differs from the whole order of spinous fishes, in producing living young. In consequence of this, its habits must be considerably different. Impregnation must take place within the body of the female, who, like most other viviparous animals, probably is distinguished by parental affection for her brood, which generally consists of two or three hundred. The season of her parturition is a little after the depth of winter; before impregnation by the male, the eggs are small, and of a whitish colour; after that period they are gradually increased in size, and assume a red appearance. By and by they acquire an oblong shape, and two black spots begin to announce the rudiments of the head and eyes; after this the belly and viscera begin to appear: they are covered with a milky pellucid membrane, through which the intestines are seen: Last of all, the tail becomes discernible, like a small thread, bending towards the extremity.

During the whole time of gestation, the abdomen of the female is greatly distended, not only by the young brood, but also by a white muddy substance, which probably supplies the nascent family with food. As the period of parturition approaches, this liquid gradually diminishes in quantity, till, upon the young attaining their full size,

B b 2

it

* *Mustela marina vivipara*, Schon. *Blennius viviparus*, Lin. Syst.

it almost wholly disappears, as if consumed by the numerous race which it has supported *.

When the foetus have acquired nearly their complete size, they creep from place to place in the uterus, as if attempting to disengage themselves from a state of confinement, which is now no longer necessary: after parturition, they are immediately capable of swimming and following the mother; and of supporting life by the same movements of the mouth and gills.

The young of the viviparous blenny, at their first appearance, are about two inches long; when full sized, they are nearly a foot. Their flesh is extremely coarse, and unsavory; it is ate chiefly by the poor, who sometimes take them in their pregnant state; and least their numerous young when dressed, should adhere to their knife or fingers, they take the female, before boiling, and strip her of her young, by passing the hand along the belly. Several of these fish are caught in the river *Esk*, in *Yorkshire*, by throwing lines from the top of the bridge †.

* Willough. p. 123.

† British Zoology, class 4. genus 20.

DIVISION III.—*Thoracic Fishes.*

SECTION VI.

GENUS XXVI.—*Cepola* *.

WE are now come to that division of the spinous tribes termed by naturalists the thoracic, from the position of their ventral fins, which are neither placed before the pectoral, nor behind them, but directly under them upon the thorax †. The first genus of this class, Linnaeus terms the cepola, in the latter editions of his *System of Nature*, from a fish of that name caught in the *Mediterranean*. This animal has an extremely slender and tapering shape; the body being twelve inches in length, and scarcely one in thickness: It is of a flesh colour, and semi-transparent, so that the vertebrae of the back appear, and can easily be numbered.

The cepola has no scales; the sides are adorned with a lineal row of silvery spots. The pectoral fins are small, and their rays so slender, that they are almost imperceptible. About an inch behind the head, rises the dorsal fin, which is produced till it joins the tail, where it meets the anal fin, which is about thrice as broad; and begins

so

* *Tecnia prima*, Rond. *Cepola tecnia*, Lin. *Syst.*

† Vide *Systema Nat.* 156.

so near the throat, that the anus is situated almost immediately below the angle of the lower jaw. This fish is sold in the markets of *Rome*; but its flesh, according to *Rondeletius*, is of a very indifferent quality*.

The only remaining fish of this genus is the red cepolla, called by the *Genoese* *cavagiro*†. The body of this species is more slender and compressed than that of the eel: The sides, back, and tail, are of a pale red; the belly white, and the whole body is destitute of scales. The dorsal fin begins immediately behind the head, extending along the back till it meets the anal fin opposite to it, at the extremity of the tail. In the larger fishes, these fins display a great brilliancy of colour; at the base they are of a beautiful yellow, and at the top a fine purple. The ventral and pectoral fins are placed exactly opposite to each other, upon the thorax.

* *De piscibus.*

† *Vide Will. p. 117.*

GENUS XXVII.—*Remora* *.

THE remora, or sucking fish of the *English*, is about eighteen inches in length, almost round. The skin is destitute of scales, smooth, and hard like leather. The head is oval, flattened, and broader than the body: The jaws are of unequal length, the lower projecting beyond the upper; both however are armed with small sharp immoveable teeth, covered by the lips †. The two ventral fins are united by a membrane; the pectoral are of a triangular shape, and two inches and an half in length.

The hind part of the head distinguishes the remora from every other fish; it extends apparently two inches upon the back; it is quite flat, and striated with transverse lines, like the palate of other fish. It is with this part that the animal adheres to the belly of the white shark so closely, that the latter when taken is found sticking fast to its skin ‡.

* Remora, Rondel. Echeneis Remora, Lin. Syst.

† Vide Guan. Hist. piscium, p. 184.

‡ De Terrey apud Willoughbium, p. 119.

GENUS XXVIII.—*Choryphæna*.

THIS genus comprehends twelve species that are all exotics: their characters are a large bony head, flat, and sloping towards the snout, which appears short and mutilated, as if cut through. The jaws are obtuse, of an equal length, and furnished with teeth; the palate is also frequently exasperated with small spine-like teeth. The back is convex and carinated, and the whole body of a uniform shape.

The Pompilus *.

THIS fish is said by *Pliny*, to accompany vessels for several hours when sailing on their voyage, and will not leave them even though threatened with destruction by the sailors †. It is an inhabitant of the open sea, and is easily distinguished by a broad curved line, proceeding from the gills to the tail. Above this line the body is variegated with a number of spots; below it, towards the belly, the sides are marked with transverse dotted lines ‡. Above the eyes is a large spot of a gold colour. The fins

* *Pompilus* Rond. Idem. *Plinii*.† *Vide* Rond. apud Will. p. 214.‡ *Historia Animal.*

fins are four, two pectoral and two ventral, besides a large dorsal and an anal fin, each extending to the tail. From its remote habitation in the ocean, this fish is but rarely caught; and even in the *Italian* markets, where it is sometimes sold, it has no appropriated name.

Another remarkable fish of this genus is the hippurus, also an inhabitant of the ocean, and never found upon our coasts. *Rondeletius* had an opportunity of examining this animal in *Spain*, where it is called *lampugo*, and appeared to him to be distinguished from the whole finny tribe by its superior beauty*. Immediately above the rostrum, there arises a large crest-like fin, which continues uninterrupted to the tail, where it meets with a similar fin upon the belly. The pectoral fins are rounded and broad, resembling ears; the ventral extend the half length of the body. The mouth is moderately large, armed in the jaws, palate, and tongue, with small sharp teeth. The eyes are large; the body covered with small scales, and of a pale blue colour.

The ancient naturalists believed, that this animal lay hid in a dormant state during winter, like the serpent; and that its young increased in size in a far more rapid manner than those of any other fish. The *Spanish* fishermen, after taking the young, shut them up in pools, where they pretend that a difference of their size is perceivable every day†. The other fishes of this genus are mostly peculiar to *South America*, and are only known by the barbarous names affixed to them by the natives.

* De piscibus.

† Aristotle Hist. Animal. lib. 5. cap. 10.

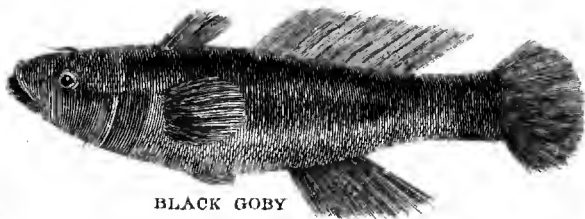
GENUS XXIX. *The Goby.*

THERE are eight species belonging to this family, that are enumerated by the *Swedish* naturalist. Their common characters are, the body straight, and gently compressed; the skin rough, with a thick coat of small imbricated and deciduous scales. The jaws of equal length, armed with small, sharp and immoveable teeth. The dorsal fins are two; the first small, consisting only of a few rays, the second broad and high; the pectoral fins are large, and rounded at the ends; while the ventral are united, and have the appearance of a funnel.

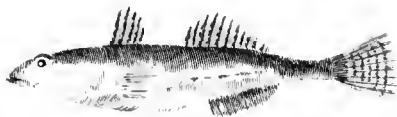
There are only two species of the goby known to frequent our coasts, the black and the spotted. The first grows to the size of six inches; the second only three, and is frequently caught in the shrimp nets upon our sandy shores*. Two or three other species frequent the *Mediterranean*; but as they are of no value, their habits and manners are but little known.

* British Zoology.

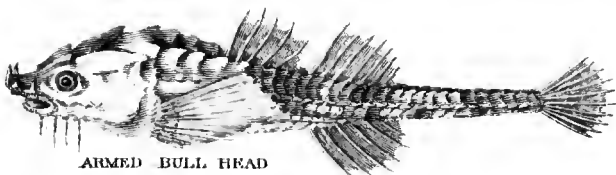
Plate XIX.



BLACK GOBY



SPOTTED GOBY

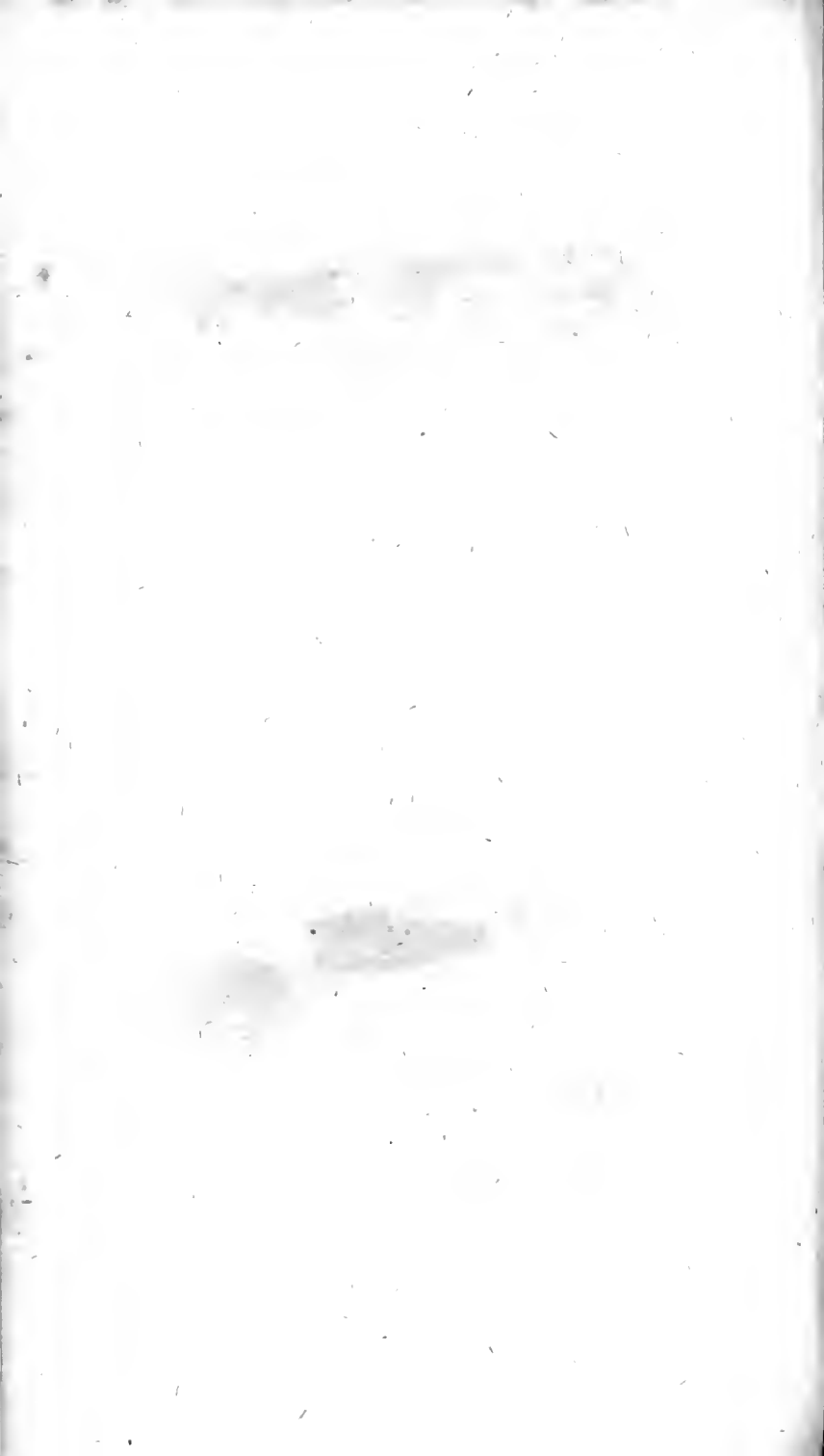


ARMED BULL HEAD



RIVER BULL HEAD





GENUS XXX. *The Bull-head.*

THIS deformed tribe is distinguished by a large disproportioned head, much broader and thicker than the body; the visage is rendered staring and hideous, by two large eyes placed above; and the whole of this unshapely head is armed with spines. Some of this genus are inhabitants of the fresh water, while others are peculiar to the sea. There are six species enumerated by ichthyologists.

*The River Goby**,

THIS small species seldom exceeds three inches and a half, and is very generally found in all our clear streams, lying at the bottom, either under a stone, or upon the gravel. It deposits its spawn in the sand, in a receptacle dug for the purpose; and its concern for its future progeny is such, that with reluctance it leaves the spot from which it is to rise. The fresh water insects are its food; the *pulex aquatilis* being frequently found in its stomach †.

The

* *Cottus Gobio*, Lin. Syst. Bull-head, Miller's Thumb. Willough.

† British Zoology.

The back is of a yellow colour, variegated with three or four transverse patches of black. The mouth as well as the head, is disproportionably large: The pectoral fins are broad and rounded; the ventral extremely small, having only four rays *. The anal, and two dorsal, are larger than usual in fishes of the same size. There is a species found in the lakes upon the continent, of still an inferior magnitude to our river bull-head, and of a brighter colour.

The armed bull-head, or pogge, as it is called in the north of *England*, is an inhabitant of the sea, much larger than the species noticed, and formidable, as well as hideous in its appearance. It is near a foot in length; the head triangular, and armed with a number of sharp tubercles upon each side; the snout is flat, and turned up, armed also on the point with four strong curved pikes; below the chin are a number of *cirri*, forming a copious beard, which adds to the threatening aspect of this animal. The body, from the head, a considerable way down, is of an octagonal shape; near the tail it becomes hexagonal, and is entirely covered with large bony scales, which give the body its angular form *.

* Willough. page 137.

† Willough. page 217.

Father Lasher *.

THIS singular animal is about half a foot in length, and in shape resembling the goby; the head and anterior parts being disproportionably large, the posterior slender as they approach the tail. It has no scales; but the sides are divided each by a rough lateral line. The head is blackish; the back variegated with pale and black patches, placed transversely: Below the lateral lines, the sides are yellow, and whiten as they approach the belly. The coverts of the gills and the crown of the head are beset with formidable spines, by the stroke of which this small fish can inflict a painful wound †.

The whole aspect of this fish is threatening; and as it knows the use of its defensive weapons, it can increase the terror of its enemies, by swelling the opercula of the gills and the cheeks to an enormous size. It seems to have been long well known in the *Mediterranean*, though not for its peaceable and innoxious habits; for it is thus characterised by the poet:

Et capitis duro nociturus scorpius ictu.

The scorpion threatening wounds with its bony head.

The

* *Cottus Scorpius*, Lin. Syft. Father Lasher, Will.

† Willough. p. 138.

The *American* species is exactly similar to our own, and is frequent in the *Newfoundland* seas, where it is called scolping. It abounds also on the coast of *Greenland*, where it is caught in deep water off these bold shores, and constitutes a very palatable dish to the natives ‡.

‡ Brit. Zool. Class iv. Gen. 22.

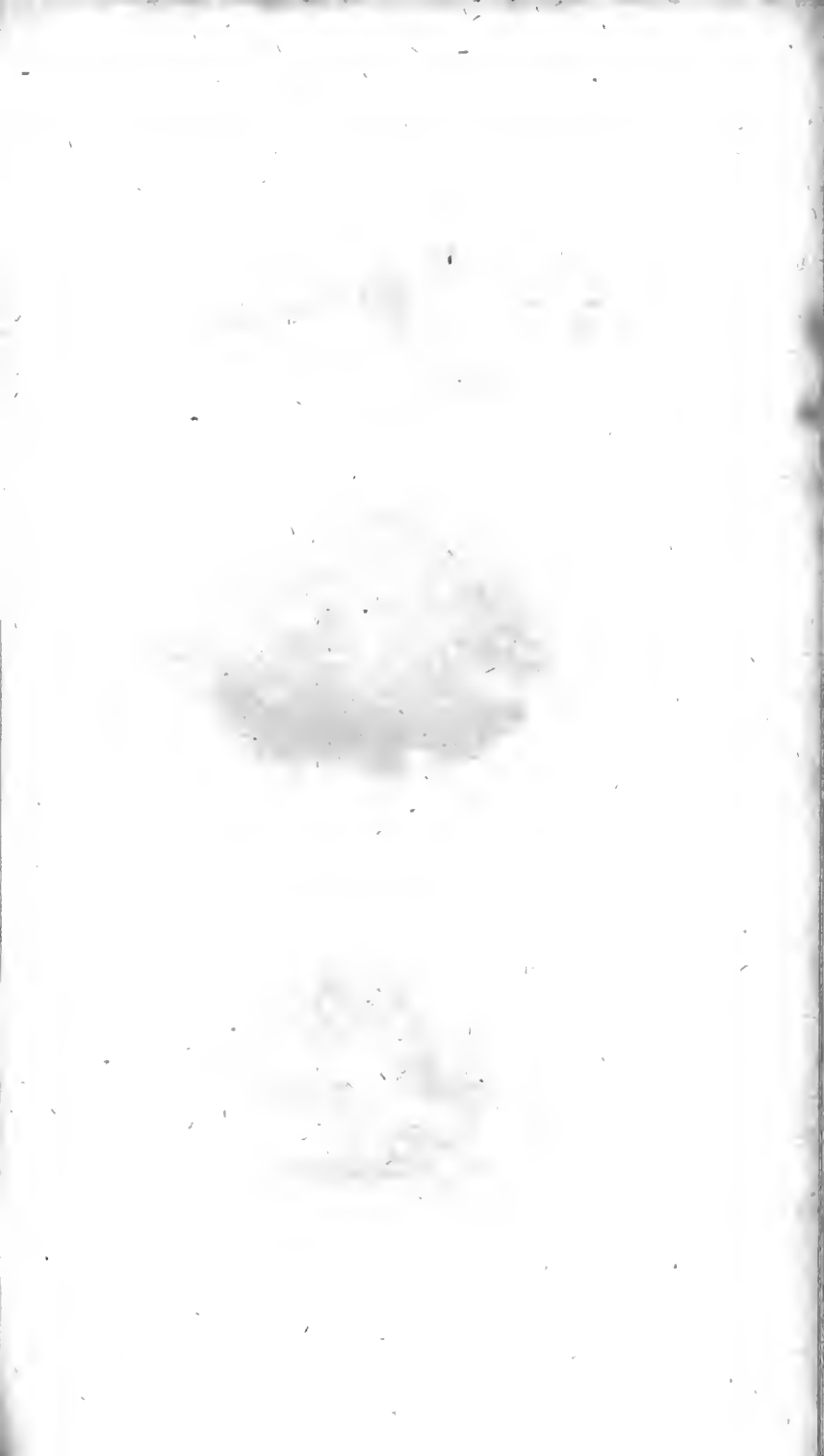
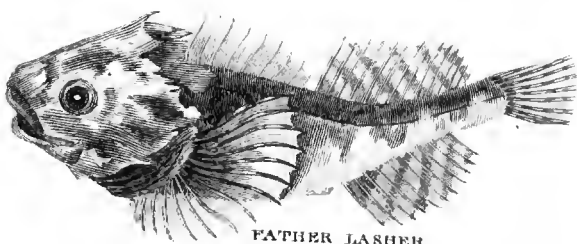
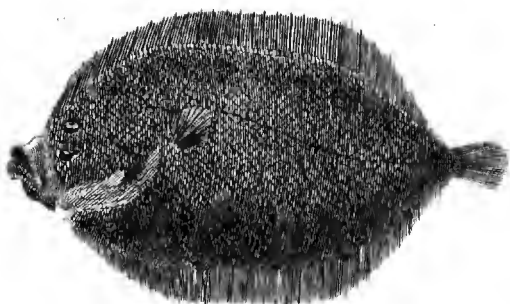


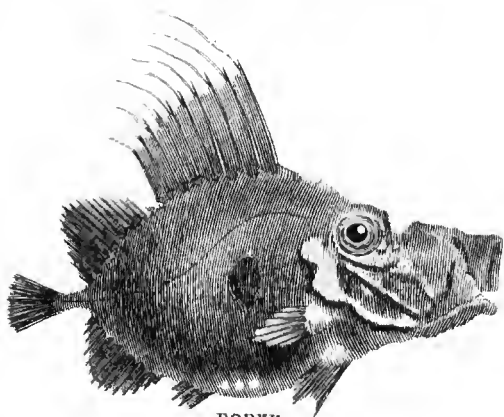
Plate XX.



FATHER LASHER



SMEAR DAB



DOREE

SECTION VII.

GENUS XXXI.—*The Doree* *.

THIS species is in all parts of an equal thickness; the body is extremely deep, and strongly compressed laterally; so that in shape it resembles the flounder; but swims erect, and not on the side. The head is flat laterally; the mouth immoderately large, being, together with the head, bigger than the body. The eyes correspond in size with the head; the pupil large and protuberant, and the irides yellow. It is sufficiently distinguished from every other fish, by the round black spot on each side, of about the size of a sixpence; a circumstance from which superstition has made the doree a rival to the haddock, for the honour of St. Peter's touch, when he took the tribute-money from its mouth, by leaving on its sides those incontestible proofs of the identity of the fish, the marks of that Apostle's finger and thumb †.

But if we are to believe the annals of ignorance and credulity, the doree may claim a still more ancient origin of the spots upon its sides; for we have read that the gigantic St. *Christopher*, in wading through an arm of the sea, over which he carried our Saviour while a child, caught

* Zeus Faber, Lin. Syst. Gallus marinus, Rondel.

† British Zoology.

caught a fish of this kind *en passant*; and as an eternal memorial of the fact, left the impressions on its sides, to be transmitted for the inspection of all posterity *.

The hideous aspect of this fish long banished it from our table, till the celebrated comedian and epicure *Quin* introduced it. It required only his assertion to make it a delicious fish, and effectually to establish its reputation among the most delicate viands of the times. It is very common in the *Mediterranean*, the *Bay of Biscay*, and on the *French* coast; so when *Ovid* terms it *rare* †, it must have been owing to its delicacy, rather than its scarcity.

There is a species belonging to this tribe peculiar to the *Indian* seas, termed by *Willoughby*, *faber Indicus*, of a very remarkable appearance; the first ray of the dorsal fin extends far beyond the tip of the tail; that of the anal fin is nearly of the same length; while the two pectoral fins seem to consist only of a single ray, and extend almost to the tail ‡.

The Opah ||.

THIS fish belongs to the genus of dorees, although it far surpasses them in magnitude, weighing in some instances an hundred and forty pounds; measuring three or four feet in length, by two and a quarter in depth. It is so much compressed laterally, that its greatest thickness is only four inches. The colour of the opah is a vivid trans.

* Willough. page 295, where Aldrov. asserts, that it is frequently hung up in the Italian churches so renowned for fable.

† *Rarus Faber*. Vide Halieut.

‡ Willough. Append. 3.

|| Opah, or King-fish, Phil. Trans. Opah, Brit. Zool.

transparent varnish of scarlet, burnished over with gold, and bespangled with oblong silver spots of different sizes. The breast consisted of a hard bone, resembling in shape the keel of a ship; and the flesh had the taste and appearance of beef*.

The opah has only been four or five times caught on the *British* shores; and as no mention is made of it by *Linnaeus* or *Willoughby*, is probably every where a rare fish. The fins, as well as the body, are of fine scarlet; and from the high encomiums lavished by those who have seen it, on its brilliant colours, we are led to suppose that it is one of the most beautiful of the tenants of the deep, and to regret its scarcity†.

* Brit. Zoology.

† Vide Sibbald. Hist. Scot. Tab. 6.

GENUS XXXII.—*The Scorpion* *.

THE animals of this tribe are found in our seas; but owing to the paucity of their numbers, they have no appropriated name in the *English* language. The species enumerated by *Linnaeus* are three. The lesser scorpion resembles a perch in its external figure; it is thick in proportion to its length, and loaded with an enormous head, rendered frightful by the strong spines with which it is beset.

The colour is a darkish dirty yellow, interspersed with brown spots. The skin is covered with extremely minute scales, resembling those of serpents. Above each eye is a small fin-like crest, as was observed in the blenny; and at the apertures of the nostrils there is a second pair. Along the back there is one large fin, which, from its lowness in the middle, has the appearance of two. The rays upon the first lobe are sharp and prickly, those upon the second are cartilaginous. The pectoral fins are broad, rounded, and prickly; each ray projecting beyond the membranes, and presenting a large spine. The ventral fins, which are exactly opposite to them, have also a spine terminating the first ray †.

The large scorpion is about five times the size of the above; the colour of a deep red, interspersed with dark spots; it is bearded below the under jaw, and has the opercula

* *Scorpena*. Lin. Syst. *Scorpana* Salviani.

† Willough. p. 331.

opercula of the gills armed at all points with strong spines. These weapons are of themselves sufficiently formidable to those employed in the capture of this fish; but they have been rendered still more frightful by a belief that they are supplied with venomous matter. *Rondeletius* mentions a boy who was miserably hurt by attempting to place one in his bosom: he is fully persuaded that the wound was poisonous, and for that reason mentions a prescription delivered by the ancients as its cure. He applied the liver of the fish, with an addition of a bruised lentiscus, to the wound, and thereby prevented those dreadful effects which were imagined to be the unavoidable consequences of a stroke from this animal ||.

|| Rondel. de piscib. art. Scorpius.

GENUS XXXIII.—*The Flounder.*

THIS genus comprehends the numerous race of flat fish, which keep constantly on one side, and reside at the bottom of the water, from wanting the swimming bladder. They make progress with one side forward, and are, on that account, termed *pleuronectes* by the author of the System of Nature, who has enumerated seven different species belonging to this tribe. The generic characters of the flounder are strongly marked: The body is flat, and one side constantly of a different colour from the other. The head, as well as the rest of the body, is covered with small imbricated scales, and both eyes are placed upon the same side of it*.

The fishes of this genus are many of them excellent food, and found in great plenty in our seas. From their extreme voracity, they are not difficult to take with the hook and line. Sometimes they have been known to swallow the plummet at the end of the sounding line, while the sailors were taking the depth of the water†.

* Guar. Hist. Piscium, p. 181.

† British Zool. Class iv. Gen. 24.

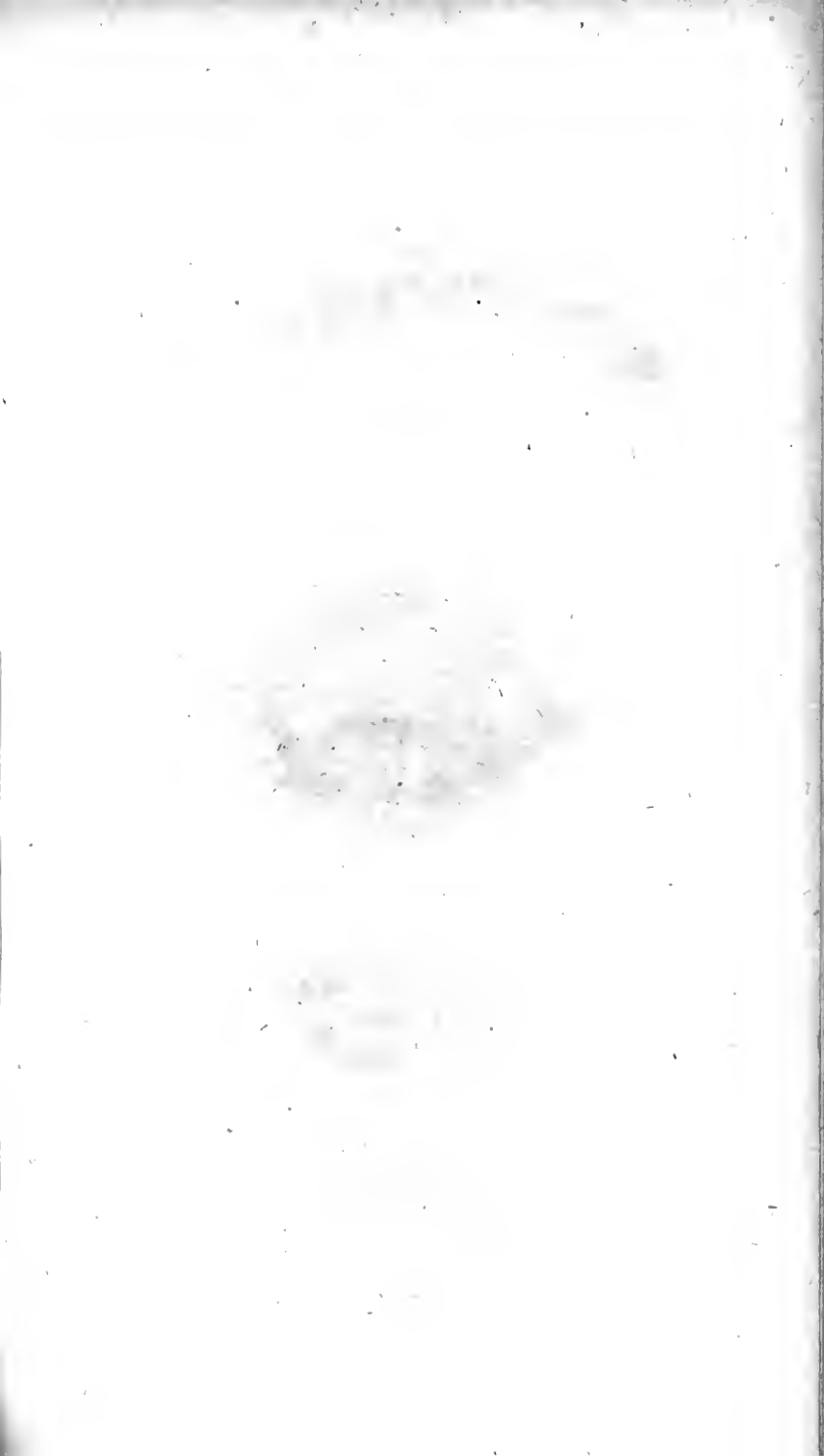
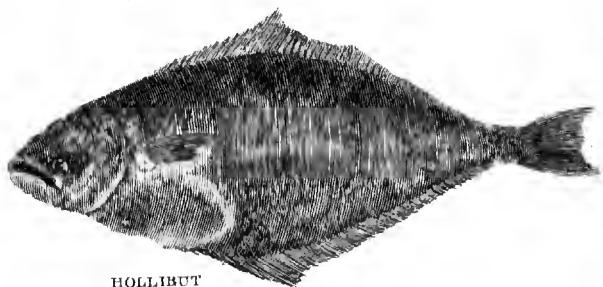
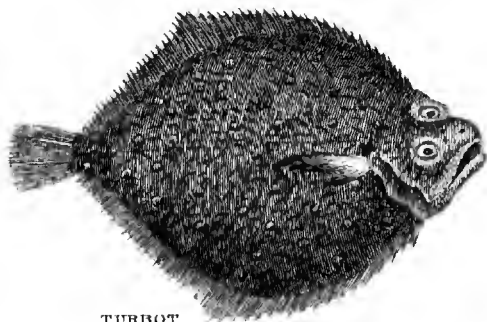


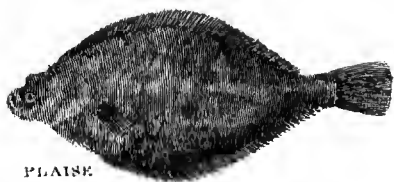
Plate XXI.



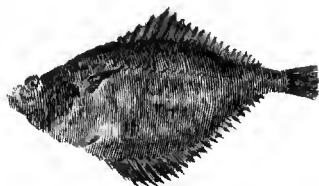
HOLLIBUT



TURBOT



PLAISE



FLOUNDER

*The Holibut *.*

THIS species is called in *Scotland* the turbot, though different from the fish known in *England* by that name. It is the largest fish of the flounder kind, and is sometimes found on our shores three hundred pounds weight, while those in the seas of *Iceland* and *Newfoundland* greatly exceed even that size. In *Greenland* they are also caught of a prodigious bulk, with the hook and line, off these bold shores: There they are cut up into large slips, and dried for food to the inhabitants. The holibut is also common in the *London* market; but where there is such an abundant variety to choose, they are deemed a coarse unfavoury fish, excepting the part which adheres to the side fins, which is fat and luscious.

The colour above is an obscure green, bordering upon black; that of the belly a pure white. The scales are small, and the body all over free from spines; even the edges of the fins have no asperity from the projection of the rays. The eyes are upon the left side of the mouth, and the right of the animal. The fin which runs along the back, begins above the eyes, and terminates about two inches from the tail; that upon the belly has its origin about seven inches from the point of the rostrum, and terminates in the same manner. There are two pectoral fins and six small ones on the belly †.

* *Pleuronectes Hypoglossus*, Lin. Syst. *Hypoglossus*, Rondel.

† Vide Will. in Piscem.

The Turbot *.

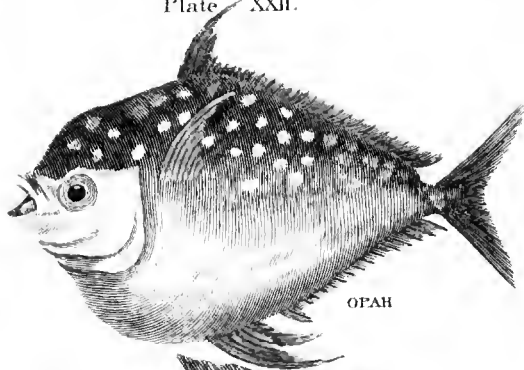
THIS species is excellent food, and grows to a great size, weighing from twenty to thirty pounds. The skin is entirely destitute of scales, but is granulated, and has different asperities here and there dispersed over it. The whole upper part of the body, together with the head and fins, is cinereous, and thick set with a variety of black spots. The jaws are not furnished with a single row of teeth, as in the other congenerous fishes, but are exasperated with a vast number of small ones; as also the palate. The eyes are placed on the left side, not so near the edge of the back, nor so close to one another, as in the rest of the flounders. The dorsal fin takes its origin farther forward than usual, beginning near the upper part of the mouth, and extending till it nearly reaches the tail †.

The turbot fishery is carried on to the greatest extent on the north coasts of *England* and of *Holland*. They are most successfully caught by the hook and line; the method practised by staked nets being very uncertain. The fishermen of *Scarborough* are most expert in their business. They go out in large cöbles, with three men in each; and every fisher has three lines, furnished with two hundred and eighty hooks apiece. The lines, before shooting, are all three joined together, when they extend about three miles, and are fastened with buoys and anchors. They are drawn at every turn of the tide, the
rapidity

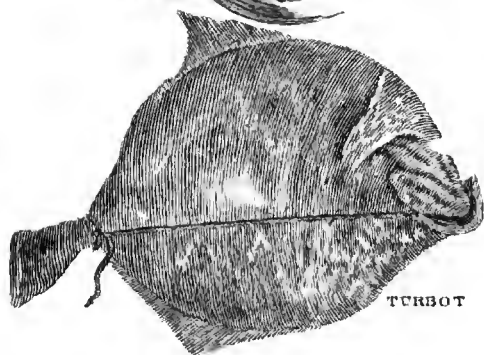
* *Pleuronectes Maximus*, Lin. Syst. Le Turbot, Belon.

† Willough. p. 94.

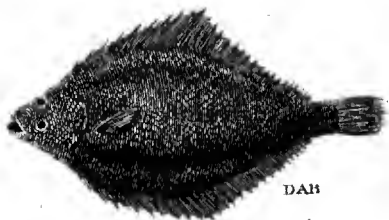
Plate XXII.



OPAH



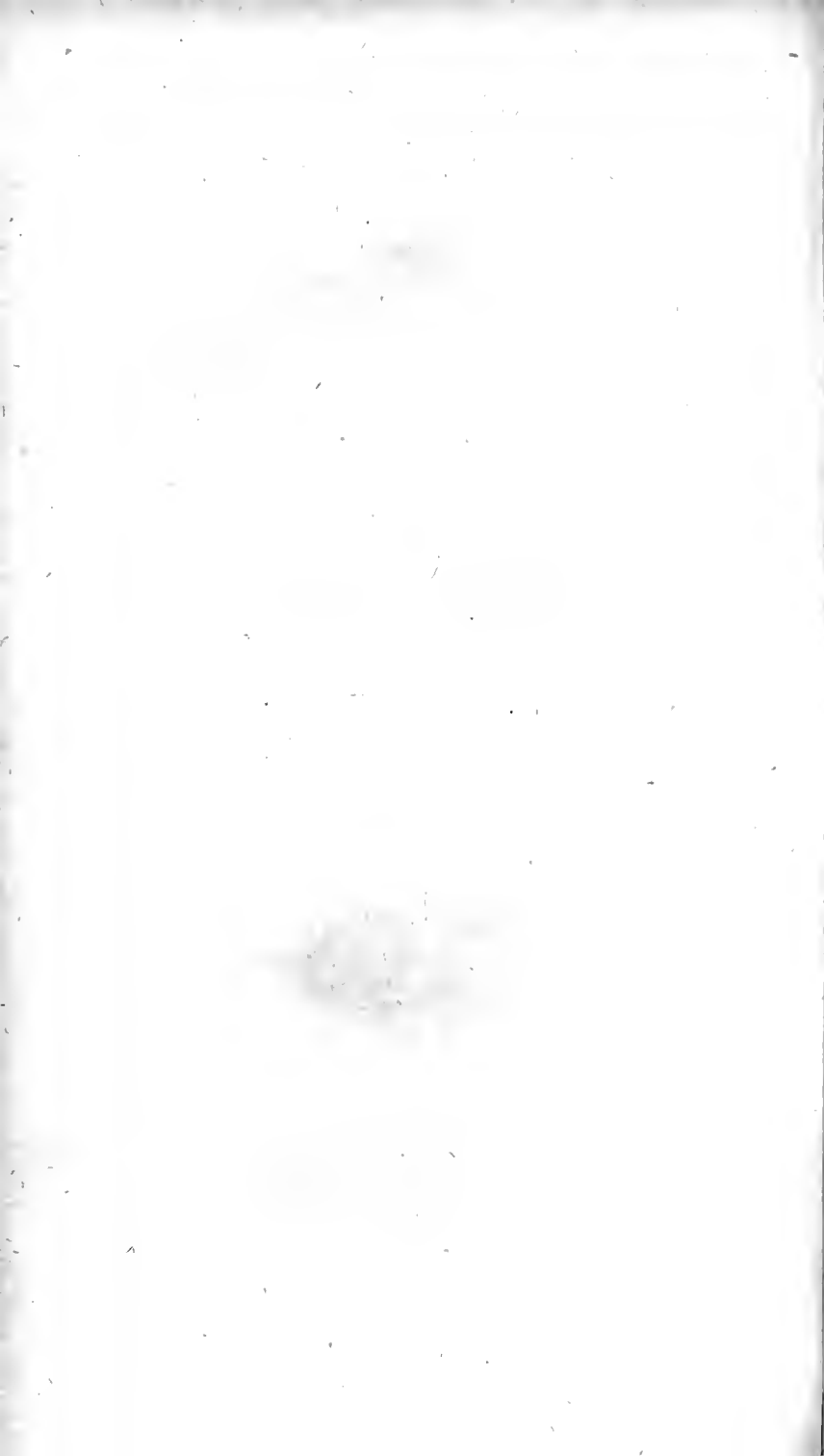
TURBOT



DAB



SOLE



rapidity of the current preventing them at any other time *.

The bait most successfully used for all kinds of ground fish, is herring, which are caught at all times during winter and spring in the *Channel*. Next to herrings, the lesser lamprey is the most approved bait: The latter are frequently carried by land from *Tadcaster*, at great expence; for though the flounders of some kinds are extremely voracious, they are so remarkably delicate with regard to a baited hook, that if a piece of herring has been twelve hours out of the water, they will not touch it †.

Of this genus there are no less than ten species known to frequent our shores: viz. the plaise, the common flounder, the dab, the smear dab, the sole, the smooth sole, the pearl, and the whiff: They are of various reputation as an article of food, and of every size, from half a pound to three hundred.

* Brit. Zoology.

† Brit. Zool. Genus 23.

GENUS XXXIV.—*Chaetodon*.

THIS genus consists of a tribe of no less than twenty-three different kinds of fish, all of them entirely exotic. Their generic characters are, an oval body, covered with very minute imbricated scales; a small flat head, with a declining rostrum; a single dorsal fin, covered with scales, and rising high above the back; two small pectoral fins; and immediately opposite, upon the thorax, two sharp pointed ventral ones. The tail is distinct from the other fins, scaly, and in some bifurcated*. As the fishes of this tribe are in general inhabitants of a different hemisphere, we shall not tire the reader with a tedious repetition of barbarous names, where the history of the animals to which they belong is altogether unknown.

* Guan. Hist. Pisc. p. 138.

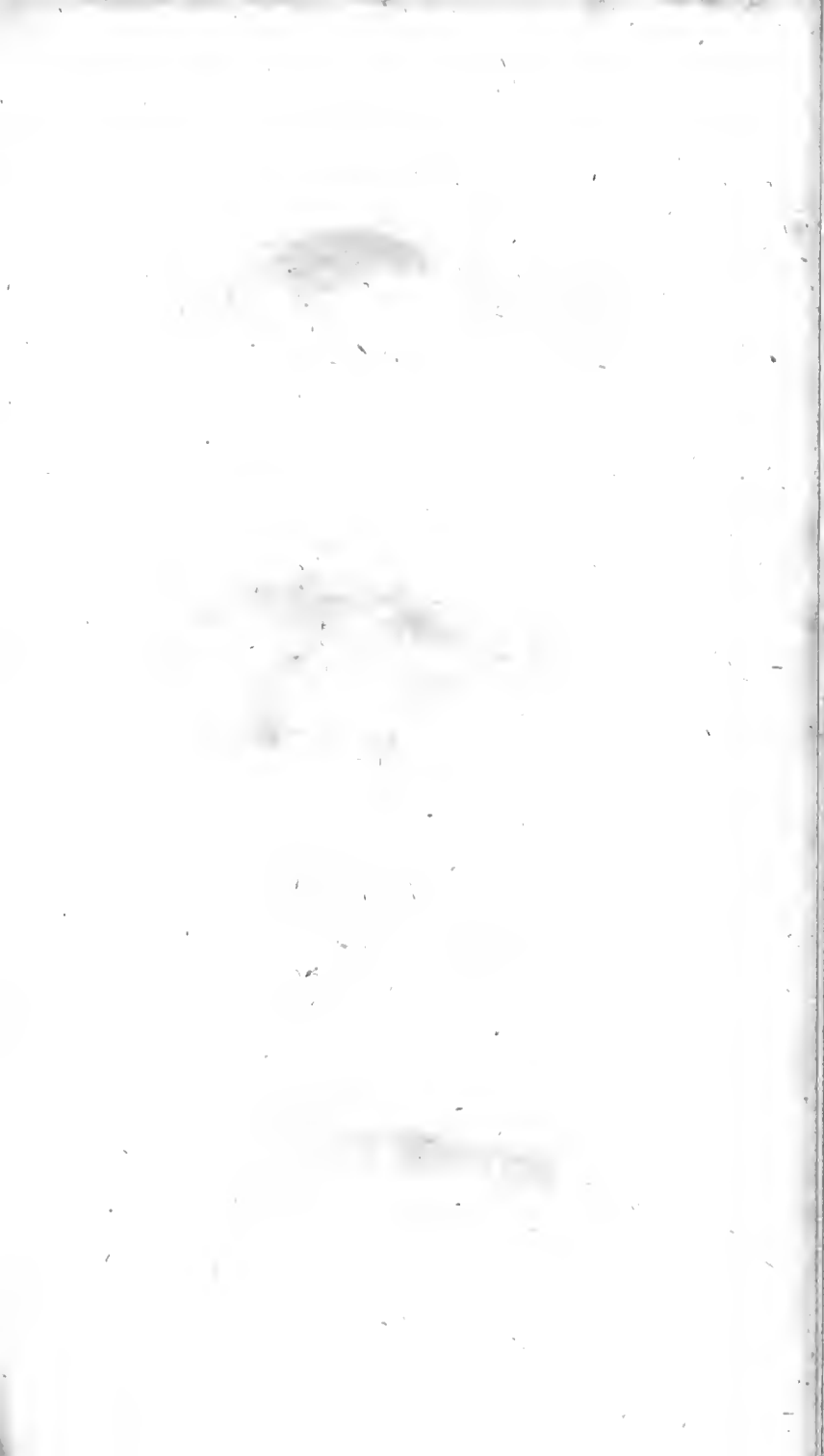
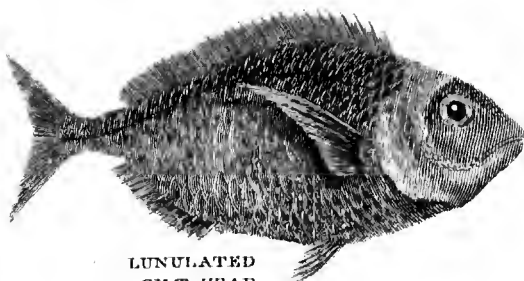
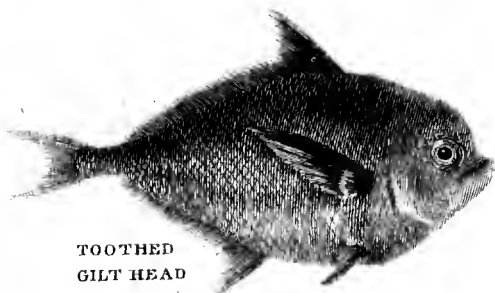


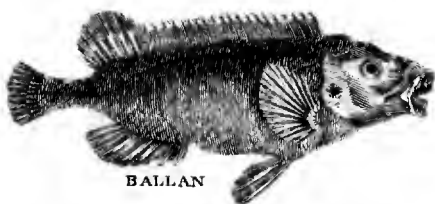
Plate XXIII.



LUNULATED
GILT HEAD



TOOTHED
GILT HEAD



BALLAN



STRIPED WRASSE

SECTION VIII.

GENUS XXXV.—*The Gilt-head.*

THE fishes of this tribe are for the most part inhabitants of the *South Seas*, where they often relieved the want of the adventurous Captain *Cook* and his hungry companions. The body is of an oval shape, carinated, and covered with very slender scales: The head is compressed, scaly, and of a moderate size; the jaws are furnished with teeth, which are covered by the lips, the lower projecting beyond the upper. There is but one dorsal, and one anal fin; the pectoral are placed near the belly, and greatly sharpened towards the end: the ventral fins are smaller, and placed somewhat behind them.

The Lunulated Gilt-head†.

THIS species is an inhabitant of the *British* coasts, where it haunts the bold, rocky, and deep shores. The whole genus to which it belongs feed chiefly upon oysters, and other shell-fish, which they comminute with their strong teeth before they enter the stomach. The apparatus of

Vol. III.

E e

the

† *Aurata*, Rondelet. *Sparus Lunula*, Lin. Syst.

the mouth is happily adapted for this purpose ; for they are all furnished with flat back teeth, resembling the grinders of quadrupeds, and fulfilling the same office. Besides these teeth, and small sharp ones on the fore part of the jaw, the inner part of the mouth is lined with certain hard bones, which assist in the arduous work of grinding and masticating their hard food *.

They are a coarse fish, and in modern times held in no great esteem, though the caprice of the ancient *Romans* set a high value upon such as were fed with the oysters of the *Lucrine* lake, perhaps for no other reason than because they were fashionable eating at a certain period : They seem, from *Martial's* account, to have thought meanly of these fish in general †.

The lunulated gilt-head grows frequently to the weight of ten pounds : The form of the body is deep, resembling that of a bream ; the back is sharp, and of a dusky green ; between the eyes is a semilunar gold-coloured spot ; the sides are of the same hue, but tinged with brown ; at the farther angle of the coverts of the gills, there is frequently a black spot, below it sometimes a purple one ‡. In this species the teeth are covered with lips ; and the back teeth are not so flat as in some others of the genus. There is but a single dorsal fin, which stretches a considerable way along the back, and has twenty four rays ; the first eleven spinous, and the rest cartilaginous : The three former rays of the ventral fin are also spinous, and the

* Brit. Zoology.

† Non omnis laudem pretiumque meretur,
Sed cui solus erit concha Lucrina cibus. Lib. xiii. Ep. 90.

‡ Willough. page 307.

the others soft. The pectoral fins are long, terminating in an acute angle; the tail has seventeen rays, and is much forked. In the winter season, the gilt-head is caught in great abundance in the *Mediterranean*, and is frequently seen in all the fish-markets of *Italy*.

F e a

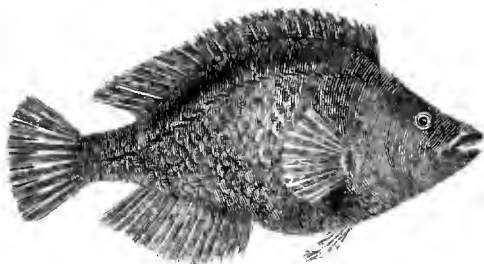
GENUS XXXVI.—*The Wrasse.*

THE fishes of this tribe are distinguished by a flat and oval body; small imbricated and resplendent fins; a compressed head; double lips covering their long conic and blunt teeth. The coverts of the gills are scaly; the tail round; and one dorsal fin reaching the whole length of the back, having a slender skin extended beyond each ray: The anal fin is distinguished by the same addition. The scari, so famous among the ancients, are of this genus: they were deemed superior to the sturgeon*. *Gesner* quotes from *Galen* high encomiums on the salubrity of their flesh. *Aristotle*, *Pliny*, *Oppian*, and *Ovid*, all concur in a vulgar and unphilosophical notion that was anciently prevalent concerning the rumination of these animals: The two first of these authors do not indeed pronounce with confidence, or assert upon their own knowledge a fact so extraordinary, but deliver it as a common opinion.

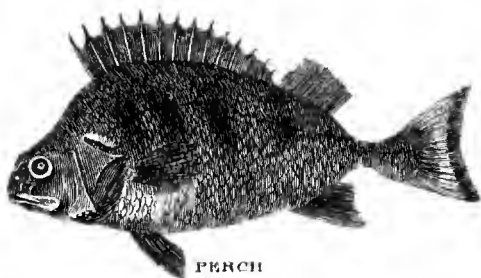
But whatever ideas the ancients entertained upon this subject, it is so contrary to the analogy of nature, for any of this class of the animal kingdom to chew the cud, that it merits no credit till confirmed by indubitable experiments. After examining the teeth, throat, and intestines of the salmon, scarus, gilt-head, and mullet, and all those fishes that have been considered as ruminating, none of the

* *Plinii*, Lib. ix. c. 17.

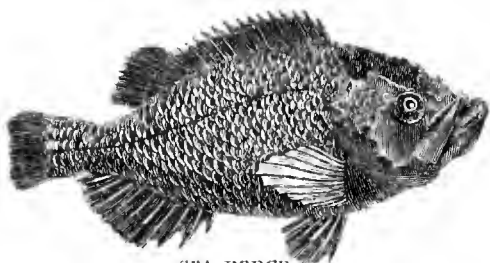
Plate XXIV



GIBBOUS WRASSE



PERCH

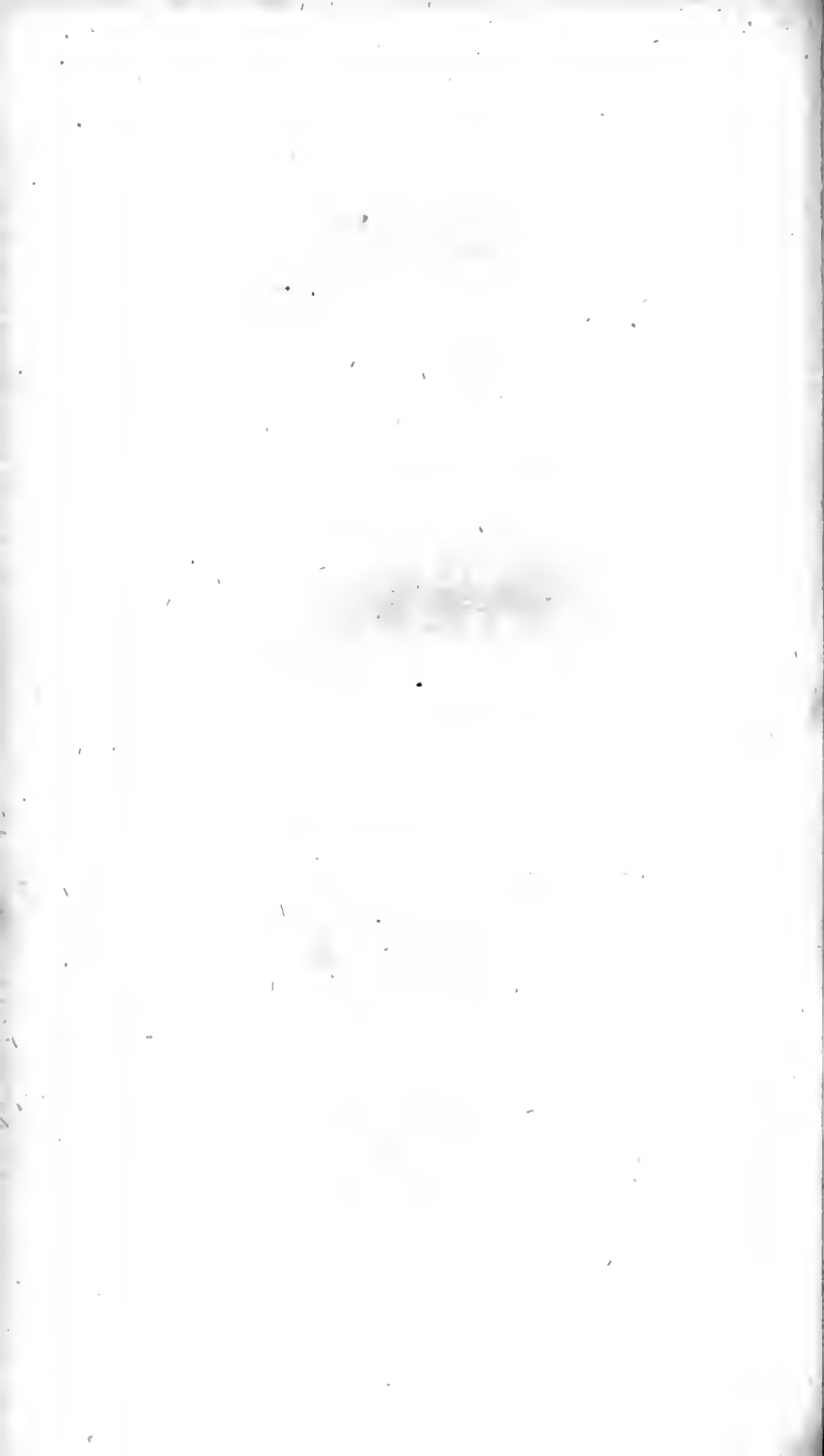


SEA PERCH



STICKLEBACKS





the requisites for that process are found to belong to them. Their food also is of such a nature, that after the first comminution in the mouth, it has no farther occasion to be brought back there to undergo a second mastication. *Pliny* indeed asserts, that the scari eat grass and weeds; which, if true, would give a shew of probability to the rumination of these fishes; but unhappily the fact, in most kinds of these fishes, seems as ill founded as the opinion which it is adduced to support †.

Belon seems to have adopted the notion of *Pliny*, as far as the food of the scarus is concerned; for he asserts, that it is only found around the island of *Crete*, the sea in other parts not producing the marine plant upon which it subsists. *Gesner*, and several of the ancients, believed that this species, as well as some others, enjoyed intervals of sleep in their subaqueous retreats; an assertion which receives no credit from the conformation of the eye; which being deprived both of eyelids and a nictating membrane, cannot possibly be shut ‡.

The Scarus ¶.

THIS animal is of a reddish livid colour, covered with broad transparent scales, and distinguished from every other fish, by certain prominent and transverse appendages on each side of the tail. The mouth is not very capacious, but stored with obtuse teeth; those upon the fore

† *Plinii. Hist. Nat. ubi supra.*

‡ *Gesner de Piscib. p. 1019.*

¶ *Scarus, Belonii. Labrus Cretensis, Lin. Syst.*

fore part resembling the human, and fitted, as is supposed, for cutting the subaqueous plants upon which it feeds *. Along the back there is a single fin, exasperated by slender spines. The belly is furnished with four fins: In this species it is uncommonly large, and filled with juicy sea-weeds. The intestines and liver are taken out, with all the feces, and made into a kind of sauce, with salt and vinegar, with which the flesh of the scarus is dressed and eaten. This is still a favourite repast among the modern *Greeks*; who, when they set in for a debauch, take large morsels of this dish, in order to give a more exquisite relish to their wine. The scari are caught in nets, into which there are introduced a number of green leaves of a certain shrub, of which these animals are fond.

The Wrasse †.

THE usual residence of our wrasse is the deep rocky shores, where it is taken with a bait; though its ordinary food is small crustaceous fishes. Of all fish, this is most liable to vary in colour; in some, it is of a dirty red; in others, it is beautifully striped, especially about the head, with the richest hues of red, blue, and yellow. The lateral lines, opposite to the extremity of the dorsal fin, are incurvated: This fin is supported by twenty-six rays; the first fifteen spinous, and the remainder soft. The pectoral fins are large, and yellow coloured; each
of

* Willough. p. 306.

† *Labrus Tinca*, Lin. Syst. *Turdus Vulgarissimus*, Will.

of the ventral has the first ray produced into a long spine; the three first rays of the anal fin are also spinous *.

The rostrum of the wrasse is protuberant, and bent upwards; and is farther lengthened by two thick fleshy lips, one of which projects upwards, while the other hangs down. The teeth are serrated, the palate smooth, while the lower part of the mouth is full of prickly teeth.

The wrasse commonly weighs from four to five pounds: In its general figure it resembles a carp. Their flesh is neither palatable nor nutritive. By the *French*, as well as the *English*, it is called the old wife, a name of which it is not easy to assign the origin. There are seven or eight distinct species of the wrasse enumerated by Mr. *Pennant* among the *British* fishes; these, however, are characterised by differences so minute, that a particular description of each would afford but little information †.

* Willough, p. 320.

† Brit. Zool. Class iv. Gen. 25.

GENUS XXXVII. *Sciana*.

THE fishes of this genus are wholly exotic; and are characterised by an oval, compressed and carinated body: The scales are very minute, smooth, and towards the back and belly raised and loose. The jaws are of unequal length, furnished with a great number of sharp, incurvated teeth, that are covered by two thick lips. They have a single dorsal and anal fin, with a loose appendage beyond the rays: The ventral fins are placed on the thorax, a little behind the pectoral, and are sharpened at the point *. A great part of the fishes belonging to this genus are black, and obtained the names of sea-crows, ravens, and umbres, from the old naturalists. Some of them are peculiar to the *Brazilian* coasts, where they are distinguished by the original *Indian* names.

The Sea-Crow †.

THIS species is of a black colour, in shape resembling a perch; the ventral and anal fins are black, as if dyed with ink; the back variegated with undulating lines, of
dark

* Guan. Hist. pisc. p. 140.

† Coracinus, Rond. Umbra, Salviani.

dark brown and blue. The snout is sharp; the mouth capacious, and instead of teeth, is roughened with small asperities; around the rostrum are various small apertures; those of the nostrils wide, and placed near the eyes. On the back are two fins, so closely adjoining, that they appear single and contiguous. The umbre, a species belonging to this tribe, is caught in the *Mediterranean*, and sold in the markets of *Rome*, where it is called onbrino.

GENUS XXXVIII.—*The Perch.*

THIS genus comprehends no less than thirty-six different species, very few of which frequent these seas; and their history is on that account but imperfectly known. Only five kinds of the perch are found in the lakes and on the coasts of *Britain*; the river perch, the sea perch, the balle, the ruffe, and the black perch*.

Some species of this tribe have one, and others two dorsal fins; some have the tail bifurcated, which in others terminates in a straight line. The body is generally oblong, laterally compressed, and covered with hard scales. The jaws are of unequal length, large, and arcuated; the teeth are incurvated, and arranged in several rows. The eyes are large and protuberant, covered with a nictating membrane, and situated at the brink of the forehead†.

These animals are remarkably tenacious of life; some of them, particularly the river perch, have been carried sixty miles among straw, and have survived the journey. Their fins are so prickly, that they are said to defy the attacks of the pike: this, however, is only true with regard to the larger perches, if it can be credited at all; for there is no animal which the pike will more readily devour than a small perch. From the ease with which the river perch is taken and transported, it has become
the

* British Zool.

† Gvan. Hist. pisc. 141.

the most common inhabitant of our fish ponds, and affords a very wholesome and palatable food.

The River Perch.*

THE ancients were acquainted with this species; and among them it was deemed one of the first delicacies of the table.

Nec te, delicias menfarum perca, filebo
Amnigenos inter pisces dignande marinis. AUSONIUS.

Rondeletius, and after him *Gesner*, blames the physicians in his time for ordering the river perch to their patients in febrile disorders, after a prescription of *Galen*, who meant the sea perch, a fish much lighter, as he alleges, and easier of digestion†. Experience, however, has shewn that this distinction is made without a difference; both the sea and river kind being found equally palatable and salubrious. In the time of *Willoughby* this prejudice against the river perch had been forgotten: He approves of the taste of *Ausonius*, in deeming the flesh of this animal a great delicacy.

The river perch is easily caught with common earth worms, or small frogs, for a bait; and is so voracious, that the angler, who falls in with a shoal of them, will sometimes kill the whole. This species seldom grows to a large size, few being found above five or six pounds,

F f 2

the

* *Perea Fluvialis*, Rond. Une perche de Riviere; Belon.

† *V* de Rond. apud Will. p. 292.

the greater number being far inferior even to that magnitude. The body is deep and oval shaped; the scales rough; the back much arched; the side line nearer it than the belly. A minute description of a fish so common would be unnecessary.

The Bass *.

THIS fish is distinguished by an uncommon degree of voracity, and hence was termed a wolf (*lupus*) by *Ovid*†, a name generally adopted by succeeding writers. In the salt water pools of *Italy*, it sometimes attains to a prodigious size, and weighs fifteen pounds; the flesh is extremely grateful to the taste‡: In the lakes they are frequently found by the fishermen frozen to death, as they suppose, but more probably suffocated by the exclusion of the air from the surface of the water; a circumstance from which *Willoughby* takes occasion to caution those who keep them in ponds to break the ice frequently during the continuance of frost §. This species inhabits indiscriminately lakes, rivers, and the sea; to the former, however, they probably ascend from the sea, for they do not seem to breed in fresh water.

Upon the back there are two fins, both radiated with spines: behind the anus another rises and proceeds towards the tail, strengthened with fourteen rays; the three first spinous: The pectoral and ventral fins have each a mixture of prickly and cartilaginous rays. The scales
of

* *Lupus*, *Rondel.* *Perca Labrax*, *Lin. Syst.*

† *Halieut.* p. 112.

‡ *Rondelct.* p. 268.

§ *Ichthyol.* p. 271.

of this fish are of a middle size, very thick set, and adhering closely to the body.

There are varieties of this species; some variegated, with dark spots, and others of an unmixed colour. The ruffe of the *English* belongs to this genus; it is the smallest of the tribe, and is found in our streams, where it frequents the deepest parts of the water, and is remarkably gregarious; large shoals being found in the same pool. It is of a much more slender form than the perch, and seldom exceeds six inches in length.

SECTION II.

GENUS XXXIX. *The Stickle-back.*

THIS genus is readily known by the formidable spines which rise from the back of the greater part of the fish that compose it. There are eleven species enumerated in the system of nature, three of which only are inhabitants of our rivers and shores; namely, that with three; that with ten, and that with fifteen spines upon the back. The former are seen in immense quantities in the fens of *Lincolnshire*, and the rivers that flow from them. At *Spalding*, they appear once every seven or eight years, in the *Welland*, where they mount the river in such vast columns, that they are used in manuring the land. An idea of their numbers may be formed, from a circumstance mentioned by *Pennant*, of a man earning four shillings a-day by taking and selling them to the farmer at an halfpenny a bushel *. The cause of these temporary migrations of the stickle-back, is supposed to arise from the vast quantities washed out of the fens by the floods, and collected in some deep hole, till overcharged with numbers, they are obliged periodically to attempt a change of habitation.

The body is oblong, compressed, and frequently covered with rough scales. The snout is long; and the mouth thick set with small granulated teeth. There is one dorsal, and one anal fin; the pectoral are small, and sharp pointed, situated upon the thorax, which is covered with *scuta* or bony plates.

* British Zoology, Class iv. gen. 28.

The Three-Spined Stickle-Back *.

THIS species is broad, and compressed laterally: it seldom exceeds two inches and a half in length; is of an olive green upon the back; the belly white: In some the throat and belly are red. Before the dorsal fin there are three sharp spines which can be raised or depressed at pleasure; behind the anus there is one, sometimes two, still stronger, which are fixed to a bony plate. The ten-spined stickle-back is of a still smaller size, and a more slender form; the sides are smooth, not plated as in the preceding species. The fishers assert, that this animal is produced spontaneously, and from them fishes of various kinds: The foundation of this extravagant notion, is their observing them in ponds newly dug, where, in the course of a few years, different fish have been found. We have already assigned our reasons for these appearances, without having recourse to such an ill-founded hypothesis †.

The Fifteen-Spined Stickle-back ‡.

SCHONFELDT first described this animal, which is an inhabitant only of the sea, and is much larger than any of the
two

* *Gasterosteus aculeatus*, Lin. Syst. Stickle-back, or Sharpking, Will.

† Vide Chap. i. sect. 4. Of the generation of fishes.

‡ *Aculeatus marinus major*, Will. *Gasterosteus Spinachia*, Lin. Syst.

two preceding. The body is slender, being only an inch thick, and nine long; towards the tail it is quadrangular, and extremely small: The whole skin is smooth; black upon the upper part, and silvery upon the lower. It has two pectoral fins, one dorsal, rising in a triangular form from the middle of the back; between which and the head there are fifteen unconnected spines, inclining a little towards the tail; on the middle of the belly there are two, at the anus one: The fins of the belly are wanting. The species inhabits the *Baltic* and *German* ocean; particularly the coasts of the *Netherlands*; it is called *erskrupper*. *Willoughby* is mistaken in supposing, that it is never found on the coasts of *Britain* *.

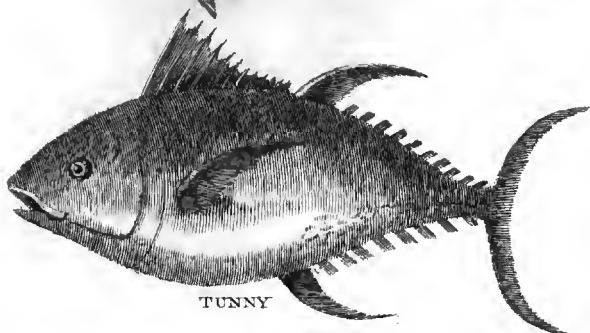
* *Ichthyolog.* p. 340.



Plate XXV.



MACKREL.



TUNNY



STRIPED
SURMULLET



SAPPHIRINE
GURNARD



LOCHE

GENUS XL.—*The Mackrel* *.

THIS is one tribe of those shoals of migratory fishes, which annually visit our coast; and it is perhaps among the most celebrated of that class, both for its numbers and the delicacy of its food. They are gregarious in their habits; and while other fishes continue in our vicinity all the year round, and proul along the shore in small numbers, or solitary, these in a compact band visit their accustomed haunts at stated seasons with so much regularity, that you can pronounce with certainty the time of their appearance.

What impels the mackrel and other migratory fishes to undertake such distant voyages, what directs their course, and what supports them upon their passage, are subjects on which naturalists have indulged in all the licence of conjecture, without being able to form any satisfactory determination. Some have imagined, that we owe the visits of the whiting, the haddock, and the mackrel, rather to their fears than their appetite; and that they are driven upon our coasts in endeavouring to avoid the pursuit of their destroyers. It is, however, more probable, that they approach the shore in quest of food, which is found in greater plenty there than in the depths of the sea †.

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It

* Scomba, Rondel. Scomba, Scomba, Lin. Syst.

† Goldsmith's Nat. Hist. vol. vi. p. 326.

It is to be regretted, that the mackrel, though perhaps the most palatable of all the gregarious fishes, is least useful, owing to its extreme tenderness, and inaptitude for carriage: It is capable, indeed, of being preserved by pickling and salting; a method, which we are surprised to find is only practised in *Cornwall*, where this food proves a great relieve to the poor during winter *.

The ancient *Romans* were just to the merits of this fish; for among them it was held in high esteem, especially on account of the *garum*, a celebrated pickle, that gave a high relish to their saucers, besides being medically useful †. According to *Belon*, this precious pickle is still in fashion at *Constantinople*. Formerly it was prepared from different kinds of fishes; but that procured from the mackrel was deemed preferable: The best was made at *Carthage*, vast quantities of mackrel being taken near an adjacent isle, called from that circumstance *Scombraria* ‡.

The mackrel is easily taken, by a variety of baits; but the capture always succeeds best during a gentle gale of wind: a coloured feather, or a piece of scarlet cloth, is often found sufficient to allure these dim-sighted animals to destruction. In spring their eyes are covered with a white film, which renders them half blind, till it is cast some time in the summer.

This fish is probably found in all the *European* seas, being universally known in that quarter of the globe. It seldom exceeds two pounds weight in the common species, and its body is of a very elegant form, and beautifully variegated

* Borlases *Cornwall*, p. 269.

† *Plinii*, Lib. xxxi. cap. 8.

‡ *Strabo*, Lib. iii. p. 109.

variegated with the finest hues of green, blue, and silver*. The common mackrel is from a foot to a foot and a half; the body thick, round, and fleshy, but tapering to a slender point as it approaches the tail, which is bifurcated. The scales are so small as to be hardly perceptible; behind the anal and second dorsal fin there are several protuberances or spurious fins, both above and below†: These may be deemed the distinguishing marks of this animal, which is too well known to require a more particular description.

The Tunny‡.

THIS species is well known in the *Mediterranean*, which they annually enter from the *Atlantic* ocean; and are taken by the inhabitants of the coasts of *Spain* and *Italy* as they advance. They were supposed by the ancients to breed in the *Levant*, and *Palus Mætis*. Some of them grow to an immense size, weighing above four hundred pounds; a magnitude which seems altogether incompatible with the short life which the ancients allotted to these animals: Both *Pliny* and *Aristotle* assert, that two years is the utmost period of the life of a tunny§.

A very extensive tunny fishery was carried on by the ancients in the *Mediterranean*; particular stations being

G g 2

fixed

* British Zoology, gen. 29.

† Willoughb. p. 181.

‡ Thunnus, Rondel. Scomber Thunnus, Lyn. Syst.

§ Hist. Anim. Lib. ii. cap. 13.

fixed upon for that purpose, near some promontory*, where a man was placed to give notice of the motions of the fish, and warn the fishermen below. It is from one of these precipices, that the lover in *Theocritus* threatens to leap, with a view of softening the rigour of his mistress's cruelty†. The manner of taking the tunny in nets, as it is at present practised, is perhaps similar to that of the ancients; many of the fishing stations are exactly the same. The trade is still carried on to a great extent: when taken, the fishes are cut into pieces and salted up in barrels, in which state they are exported to all the neighbouring countries. The abdomen is reckoned by far the most delicate part of the fish: it is cut separately, and sold to the nobility and wealthy citizens of *Rome*, under the name of tarentello‡.

The tunny frequents the *English* coasts, but not in the same numerous shoals that are seen in the *Mediterranean*§. It is also pretty common in the lochs on the western coasts of *Scotland*, where it comes in pursuit of herring, and often during night strikes into the nets, to the great damage of their owners. In the morning, when the nets are drawn by the fishers, the tunny watches near them, for any fish that may chance to drop out. The fishermen avail themselves of this avidity for prey in the tunny, and baiting a hook with a herring, they seldom fail to take him.

The flesh of the tunny, when recently taken and cut up, has the appearance of raw beef; but after boiling, it turns pale and tastes like salmon. They are about eight
feet

* These were termed Οὐνοσκοπέια.

† Vide Salvian. apud Will.

‡ Vide Idyllia.

§ British Zool.

feet in length, the body round, thick, and fleshy; but growing slender towards the tail, where it has a . angular shape. The two fins on the back are each strengthened by fourteen strong spines; those of the first are capable of being depressed, and folding so closely into a fulcus in the back, that they become imperceptible. Behind the anal and second dorsal fin, there are a number of small spurious ones both above and below.

GENUS XLI.—*The Surmullet.*

THIS genus comprehends the three species of mullets; all fishes of the most delicate kind: some of them were in such request among the *Romans*, that they were bought by the private citizens for their weight of silver. It was in the purchase of this fish, above all others, that the wealthy senators shewed their extravagance and sensuality. *Juvenal* and *Pliny* afford ample testimony of the luxury of their age, which, happily for mankind, has never been equalled in any other period of human society*. An instance of sixty-four pounds being paid for a fish of three pounds weight, is recorded by *Pliny*†.

But the manner of dressing and eating these fish, still more than the extravagance of the price, shewed the epicurism of the ancient entertainments. The mullet was not reckoned worth a farthing if it did not die in the hand of your guest. There was water kept in the eating room into which the living animal was put, and from thence conveyed immediately to the stew, where it was dressed, which was also in the same apartment, and under the table; from thence the fish was placed upon it.

It

* *Mullum sex millibus emit, Æquantem sane paribus sistentia libris.* This sum is equal to 48l. 8s. 9d. *Juv. Sat. xv.*

† That of *Asinius Celer*, a man of consular dignity, *Vide Lib. xx. cap. 17.*

It was customary to put the mullets into glass vases, that the company might be entertained with the various changes of their rich colours as they lay expiring *. It was *Apicius*, that prince of gluttons†, that first hit upon the ingenious invention of suffocating them in the exquisite *Cartbaginian* pickle, and afterwards procuring a rich sauce from their livers.

The Striped Surmullet ‡.

THERE are three species of this genus, the red and the striped, which are sometimes found in the *British* seas, and the king of the surmullets, a fish peculiar to the *Mediterranean*, and destitute of the two *cirri* which hang from the chin of the other species. The striped surmullet is about fourteen inches in length, and weighs about two pounds and an half. The body is thick; the snout blunt, and from the lower side of it hangs two beards, about an inch and an half long. The fins are of a beautiful red, and yellow; the colours of the body vary in their hues, into a thousand different shades, while the animal is dying.

* *Vitriis ollis inclusi offeruntur, et observatur morientium color, quem multas mutationes luctante spiritu vertit.* Seneca, Nat. Quæst. lib. 3.

† *Nepotum omnium altissimus gurgis.* Pliny, lib. x. c. 48.

‡ *Mullus major*, Will. *Mullus Surmuletus*, Lin. Syst.

GENUS XLII.—*The Gurnard.*

THE distinctive characters of this tribe, called by *Linnaeus* trigla, are, a scaly body, of an uniform shape, compressed laterally, and attenuated towards the tail. The head broader than the body; and sloping towards the snout, where it is armed with spines; the upper jaw divided, and extending beyond the lower. The eyes are far from the rostrum, near the top of the head large and prominent, particularly the upper margin of the orbits. The two dorsal fins are unequal; the first short, high, and aculeated; the second, long, sloping, and radiated. The ventral and pectoral fins are uncommonly large; and from their base there hang three loose and slender appendages*.

To this genus belongs the flying fish of the sailors, or trigla volans of *Linnaeus*, remarkable for the length of the pectoral fins, which it sometimes uses for the purpose of flying. There are two species of the gurnard that participate in this manner the powers of the feathered race; they are both found only in warm latitudes, and nature has probably vouchsafed them this endowment, to enable them to escape from their numerous pursuers below. It is a curious spectacle in the intra-tropical regions to behold a thousand of these fishes, all
 darting

* Guan. Hist. pisc. p. 148.

darting from their native element ; and while they endeavour to avoid the pursuit of the dolphin below, falling into the power of enemies still more dextrous and inveterate in the aerial element. The flights of these ambiguous animals are but short ; for as soon as their wings dry, they drop back into the subjacent waves without a possibility of rising till they are again wetted there : It is from the sudden drying of their wings, that they often fall upon the decks of vessels, particularly those that double the *Cape of Good Hope*. These fishes are seen in the *Mediterranean*, but seldom venture farther from the line ; none of those that frequent the *British* seas are capable of rising from their native element*.

The Gray Gurnard†.

THE colour of this fish, upon the back, is a dirty green, variegated sometimes with black, but more frequently with clay-coloured spots : Below the lateral line, which is remarkably rough, the colours are more diluted, and the white spots more frequent, till you approach the belly, which is silvery. The head is large, covered with bony plates, of which the highest that covers the top of the head, runs backwards, and terminates in two sharp horns or spines. The snout, and upper part of the eyes, are also fortified in the same manner by spines. The

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jaws

* *Vide* Willough. et Marcgr. de piscib. Bray.

† *Gurnardus Griseus*, Will. *Trigla Gurnardus*, Lin. Syst.

jaws, and the whole inner part of the mouth, are covered with very small teeth. The eyes are large; the irides of a silver colour, with a tincture of brown: The nostrils are small, and placed on the sides of the rostrum: On the extremity of the gill covers, is a thick, sharp, and long spine. The first dorsal fin consists of eight spiny rays; the sides of the three first tuberculated: The second has nineteen rays, and is lodged, like the former, in a groove, rough on each side. The pectoral fins are long and transparent, and supported by ten rays; from their base hang three beards*. The *British* fishes of this genus are, the tub fish, the seraphine, the streaked, the gray, and red gurnard, and the piper; the last, *Rondeletius* has termed the lyre, on account of its bifurcated rostrum, which somewhat resembles that instrument among the ancients. The whole of this genus is excellent food.

* British Zoology, gen. 31.

DIVISION IV.—*Abdominal Fishes.*

SECTION X.

GENUS XLIII.—*The Lochæ.*

WE are now come to the last division of the spinous fishes, termed by naturalists, the abdominal, from the situation of their ventral fins, which are placed far behind the pectoral in the abdomen. The loche, or cobitis of *Linnaeus*, which is placed at the head of this tribe, is perhaps the most unshapely of the whole race. The body is compressed laterally, and nearly of the same depth from the head to the tail : It is destitute of that symmetry and elegant tapering form, which is characteristic of the greater part of fishes. The scales are deciduous, and so small as scarcely to be perceived. The back is marbled with brown spots, upon a paler ground of the same colour; the belly, a dirty white*.

Linnaeus has five species, that are peculiar to our rivulets. The loche seldom attains to the size of four inches; and is rendered hideous by a beard that projects all round the snout. Forbidding, however, as this animal may seem, we are told our sportsmen sometimes swallow it down alive in a glass of wine†.

H h 2

The

* Guan. Hist. Piscium, p. 205.

† British Zoology.

The body is smooth and slippery, and almost of equal thickness; the two dorsal and caudal fins are marked with small spots, the latter somewhat rounded, and barred with stripes of black. This disgusting fish, which constantly crawls at the bottom of our rivers, is by some reckoned a delicate food, when made into a kind of sauce. They generate commonly in the month of April, among the long aquatic weeds about the brink of the rivers †.

† Willough. page 265.

GENUS XLIV. *Amia*.

OF this genus there is only one species, distinguished by the baldness of the forehead, which appears as if excoriated. The body is slender, a little compressed, and covered with imbricated and flexile scales; the head is bony, rough, and flattened; the jaws of equal length, and furnished with a number of sharp erect teeth; the tongue is obtuse; the palate armed with two teeth; near the eyes are two apertures of the nostrils; and not far from them are two beards.

There is only one dorsal fin rising from the middle of the back, radiated and sloping; the ventral and pectoral fins are small; the former placed behind the equilibrium of the fish, in the abdomen. The tail is rounded, supported with rays, and short ||.

|| Guan. Gen. Piscium, p. 208.

GENUS XLV. *Silurus* *.

A VARIETY of exotic fishes are contained in this tribe; that which we select for description is found in the *Danube* and *Vistula*, sometimes in the *Rhine*, and the lakes of *Germany*. It grows to the length sometimes of sixteen feet, and weighs an hundred and fifty pounds. At *Vienna*, *Willoughby* observed them of this prodigious bulk †. The belly seems as if worn by continual rubbing on the ground, whence it is probable that the silurus frequents the bottom of the water. It is extremely voracious, and destructive to other fish wherever it appears: by many it is commended as an article of food, when skilfully dressed.

This animal resembles the eel in colour, and that viscid substance with which the body is covered. The belly and sides are variegated with large spots of black and white, and the whole is destitute of scales. The head is broad, and much flattened. When the jaws are open, the gape of this fish is tremendous; for it extends almost the whole length of the head. Before the eyes there are two antennæ, resembling the feelers of insects, and probably destined to serve the same purpose. From the under lip, there hang four similar feelers, which the animal is said to cast annually ‡.

The

* *Silurus Rondel.* The Sheat-fish, Will.

† *Ichthyology*, page 128.

‡ *Vide Gesnerum apud Will.*

The dorsal fin is small, having only three rays ; from the anus to the middle of the tail, there is a very long fin, supported by twenty rays ; the pectoral fins have each a strong spine projecting from the first ray, which the animal probably uses as an instrument of defence.

GENUS XLVI.—*The Teuthis.*

THE two species which *Linnaeus* has arranged under this genus are both exotic fishes. The generic characters are, a cylindrical body, covered with tuberculated scales, which give the animal somewhat of an angular shape. These scales are thinly set, scarcely imbricated, and are extremely rough to the touch. The head is broad, flattened horizontally, and sloping towards the snout, which is obtuse. The mouth is destitute of teeth; the eyes distant from the snout, placed almost on the top of the head, and covered with an entire nictating membrane. On the inner side of the lips are innumerable cirri, which serve the animal instead of teeth*.

A *Brazilian* fish, termed by the natives guacari, belongs to this genus. The fins are in general supported by very strong spines. The tail, which in the lower division is about three inches in length, and two in the upper, is supported by very strong spines. The whole head is covered with a rough kind of shell; the scales of the body triangular, and arranged in rows, forming a strong coat of mail, well adapted for defence†. The whole body of this fish is of a saffron colour, diluted towards the belly, but deep upon the sides and back; over this ground there is dispersed an innumerable quantity of small brown spots, resembling mustard seeds. The native *Brazilians* eat this fish; but after the bulky tegument is subtracted, very little flesh remains, and that of no exquisite quality.

* *Guian. Hist. Piscium*, p. 188.† *Willough.* page 277.

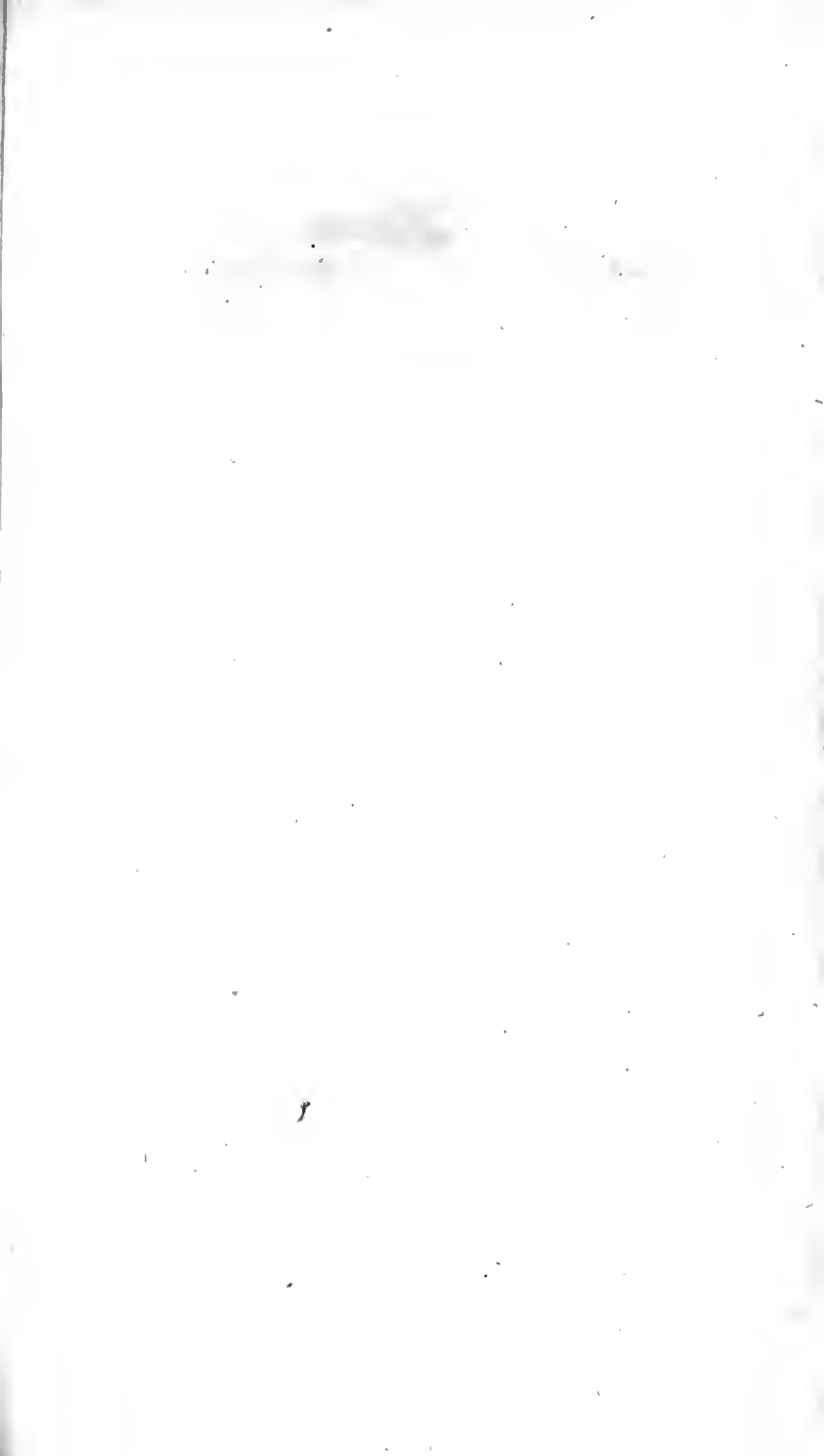
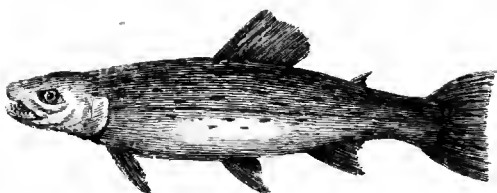


Plate XXVI



SALMON



SALMON TROUT



TROUT



SAMLET

GENUS XLVII.—*Salmon*.

THIS family contains seventeen species, many of which are perfectly familiar to the inhabitants of this island, being found in all its lakes, rivers, and shores. The most remarkable for beauty and utility is the common salmon, whose external figure may vie in elegance with that of any fish that swims, and whose flesh is well known over all *Europe* for its agreeable taste and nutritive quality.

A minute description of the parts of the common salmon would be superfluous. It is found over all the north of *Europe* and *Asia*, from *Britain* to *Kamschatka* *; but does not venture into the warm or intratropical latitudes. It is frequent as far north as *Greenland*, and is seen in some of the rivers of *France*; but none have been caught so far south as the *Mediterranean* †.

The salmon is an ocean fish, and therefore is only found in those rivers and lakes that communicate with the sea. As the ancient *Grecians* never extended their empire to the ocean, they were unacquainted with this excellent fish; and hence their language has no name to distinguish it ‡. The extent of the *Roman* territory gave them many opportunities of being acquainted with the salmon; and in their language it has a name from which ours is borrowed; the word seems to express its bounding or leaping ||.

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I i

Among

* Hist. of Kamsch. p. 143.

† Rondel. Fluvial. 167.

‡ Gesner, apud Will. p. 129.

|| A Salio ut videtur.

Among several nations the salmon has different names, according to the age of the fish. The ancients distinguished them into *salmones*, *fariones*, and *salares*, according to their age *. In *England*, the inhabitants of *Yorkshire* call those of the first year, smelts; of the second, sprats; of the third, morts; of the fourth, fork-tails; and of the fifth, half fish; for it is not till the sixth year that this animal attains its full size.

There are salmon-fisheries in *Iceland*, *Norway*, and *Lapland* †; but no where are they carried on to greater extent than in *Britain* and *Ireland*; the fishery of *Coleraine* in the latter kingdom being an inexhaustible fund of provision and of wealth.

The long migrations of the salmon at the spawning season is, perhaps, the most extraordinary part of its history. It annually mounts rivers, sometimes to the distance of several hundred miles, till it finds a place in their gravelly bed, fit for depositing the seeds of a future family. There are hardly any obstructions which it will not overcome, to attain this purpose. It easily makes its way against the most rapid current, and will leap up cataracts of an astonishing height. In endeavouring to surmount these perpendicular falls, it often fails in the attempt, and tumbles back into the water, and thus is in some places caught in baskets placed below the current.

The manner of depositing their spawn, after having performed these arduous journies, is curious. When a proper place is selected for the purpose, the male and fe-

2

male

* *Teguc inter geminas species neutrumq. & utrumque,
Qui nec dum Salmo, nec jam Salar, ambiguusque;
Amborum, medio Fario, intercepte sub ævo.* ARSON,

† Hackluyt, Voy. I. 416.

male unite in digging a pit of eighteen inches deep, into which the former ejects his smelt, and the latter her spawn: The place is carefully covered up with their tails, which at that period are worn bare. In this state, the spawn lies buried from December till Spring, if not disturbed by violent floods; while, in the mean time, the parent fishes hasten back to purify and strengthen themselves in the sea; for, after spawning, they are lean and flabby. It is when they first leave the sea that they are plump and vigorous; and such as are in that condition have a number of insects adhering to them above the gills*.

About the latter end of March, the ova begin to exclude the young salmon, which are then resuscitated, and swarm in numbers, of which it is difficult to form any idea. They are then termed fry in *Scotland*, and smelts in the south of the island; and they remain in the fresh water till the arrival of a flood, by which they are swept down into the sea. In June, the young salmon begin to appear again in the rivers, in dropping single fish: there they increase with amazing rapidity in size; for in June, when they appear first in the rivers, they are only about a foot or fourteen inches in length; and in August some are seen eight and nine pounds.

The quick growth of the salmon is by no means occasioned by the voracity of these fish; for all the fishermen agree, that no food is ever found in their stomach. Perhaps this may be owing to a temporary neglect of food about the season of spawning or fecundation, as is the case with the sea-lions. It is well known that the

* The *lernaæ Salmonæ*, Lin. Syst.

angler takes them successfully with the fly, the worm, or small fish, an evident proof that these are the animals on which they feed.

At *Berwick* on the river *Tweed*, the capture of the salmon is immense during the month of July. At that season, they are salted, and barrelled up for exportation: Even the immense consumption of *London* not being able to keep pace with the vast loads that are daily taken.

Upon the *Tweed* there are above forty different fisheries, extending about fourteen miles up the river, which are rented at the sum of 5400 l. annually: The expence of fishing-tackle, servants wages, and other requisites, amount nearly to an equal sum; so that upwards of 10,400 l. must be obtained by the different lessees, before they can clear their expences; and hence, 208,000 salmon must be caught there, upon an average, every year, before any profit can accrue to the tenants.

The fishing season commences on the 30th November, and ends on Michaelmas day. The corporation of *Berwick* are conservators of the fishery, part of which belongs to that town. The river being the boundary of the two nations, the whole north side is *Scotch* property*.

The rivers both of *Scotland* and *Ireland* abound with these fish; and a pretty extensive capture is made in some of them. The mode of preserving them is nearly the same with that practised in *Berwick*, and the markets are similar; for in these kingdoms they begin to export during the summer months, after the *London* market is supplied. Very severe laws were enacted in *Scotland* for the preservation of salmon. So late as the reign of
James

* Vide British Zoology, Gen. xxxiii.

James IV. killing this fish was made capital after the third offence; before that period, the culprit might redeem his life*.

Various causes have of late operated to the prejudice of the *British* trade in this important article. The great increase of the *Newfoundland* fishery has reduced the price of salmon in the foreign markets, while the gradual increase of knowledge throughout *Europe* has led to a much greater relaxation in the discipline of the *Romish* church, and particularly in the article of abstinence; a regimen which is daily losing credit as a spiritual restorative. And to these circumstances we may also add, the great improvement in agriculture that has every where taken place in these kingdoms within the last fifty years; which, by the frequent application of lime upon the soil, has probably greatly diminished the number of salmon, as well as of other river fishes.

The Sea-trout †.

THIS species is larger than the common, and differs from it in its habits and colour, as well as in size. It annually migrates like the salmon, from the sea; and after having deposited its spawn, it again returns to its favourite residence in the ocean. The shape is more thick than that of the river-trout, and its weight sometimes above three pounds.

* Vide Regiam Majest. Rob. III. cap. 7.

† *Salmo Trutta*, Lin. Syst. *Trutta Salmonata*, Will.

pounds. It differs from the salmon, in having the tail terminating in a straight line. The head is thick, smooth, and dusky; the back is of the same colour, but grows fainter towards the sides, which are marked with large irregular spots of black. The flesh, when boiled, is paler than that of the salmon, but grateful to the taste*.

Another species, or perhaps variety, of the trout, is the samlet, the smallest of the kind, and by some accounted the fry of the salmon at a particular stage of their growth: but as this species remains in the rivers after the departure of the young salmon, and is of a much smaller size than they are after their return, the inference is obvious, that it must belong to a different tribe. It nearly resembles the river-trout; but may be distinguished by a broader shape; by its superior whiteness, and by the shape of its tail, which is more forked; and, lastly, by the smallness of its size, which is much inferior to that of the trout†.

The River-Trout †.

THE common trout is a fish universally known in this island, for the delicacy of its flesh, for the sport it affords to the angler, and for the superior beauty of its colours. The common species it is unnecessary to describe; but there are some varieties not unworthy of notice. The colours of the trout vary greatly in different waters: In
Llyndivi,

* Willough.

† Brit. Zoology, Gen. 33.

‡ Salmo Fario, Lin. Syst. A Trout, Will.

Llyndivi, a lake of *South Wales*, are trouts marked with red and black spots, as large as sixpences. In *Loch Neagh* in *Ireland*, and *Hulse Water* in *Cumberland*, there are trouts taken which weigh about thirty pounds. These are probably of the same species with the celebrated trout of the lake of *Geneva*. The size alone of these fishes can recommend them; for in taste and flavour they are all inferior to our common river-trout.

It is remarkable that neither the *Greek* nor *Roman* authors make any mention of this fish, and that a species of such delicacy should never have become a fashionable dish. In the *Italian* rivers the trout abounds, and in all probability did so at the time when the *Romans* were transporting oysters from *Sandwich**, and the livers of the scari from the coast of *Africa*†. But it was perhaps owing to its proximity of situation, and to the ease with which it might be procured, that the trout was despised by the votaries of *Epicurus*, who scrupled not to lavish a large fortune on a dish of flamingo's tongues, and other insipid rarities‡.

It is the voracity of the trout that leads the way to its destruction, and makes it a prey to the inventions of the angler. The passion for angling is so great, that in the neighbourhood of *London*, ten pounds a year is the sum paid for the liberty of fishing in some of the adjacent rivers.

But there is a smaller fish in some parts more plentiful than the trout, which affords superior diversion to the sportsman, and that is the parr, a fish of remarkable beauty, and elegant proportions. This beautiful species

is

* *Juven. Sat. iv. 141.*

† *Suetonius in Vita Vitellii.*

‡ *Martial, Lib. xii. Epig. 71.*

is a well known inhabitant of the greatest part of those pure and rapid streams which descend from the mountains in the *Highlands of Scotland*, where we have witnessed above twelve dozen taken with a single rod and line in a few hours.

The Charr *.

THIS species is very properly denominated the *Alpine charr* by *Linnaeus*; for its constant residence is in the lakes of the high and mountainous parts of *Europe*. A few are found in some of the lakes in *Wales*, and in *Loch Inch* in *Scotland*; from which last it is said to migrate into the *Spey* to spawn: Seldom, however, does this species venture into any running stream; its principal resort is in the cold lakes of the *Lapland Alps*, where it is fed by the innumerable larvæ of gnats that infest those dreary regions. When the *Laplanders* migrate to the distant lakes during summer, they find a ready and luxurious repast in these fishes; which to them are extremely palatable without any sauce: accustomed to temperance, and exercise, these hardy natives are independent of the inventions of epicurism †.

The largest and most beautiful charrs are found in the lake of *Winander-Mer*, in *Westmoreland*, where there are
three

* *Salmo Alpinus*, Lin. Syst. *Umbla minor*, Gessner.

† *British Zoology*.

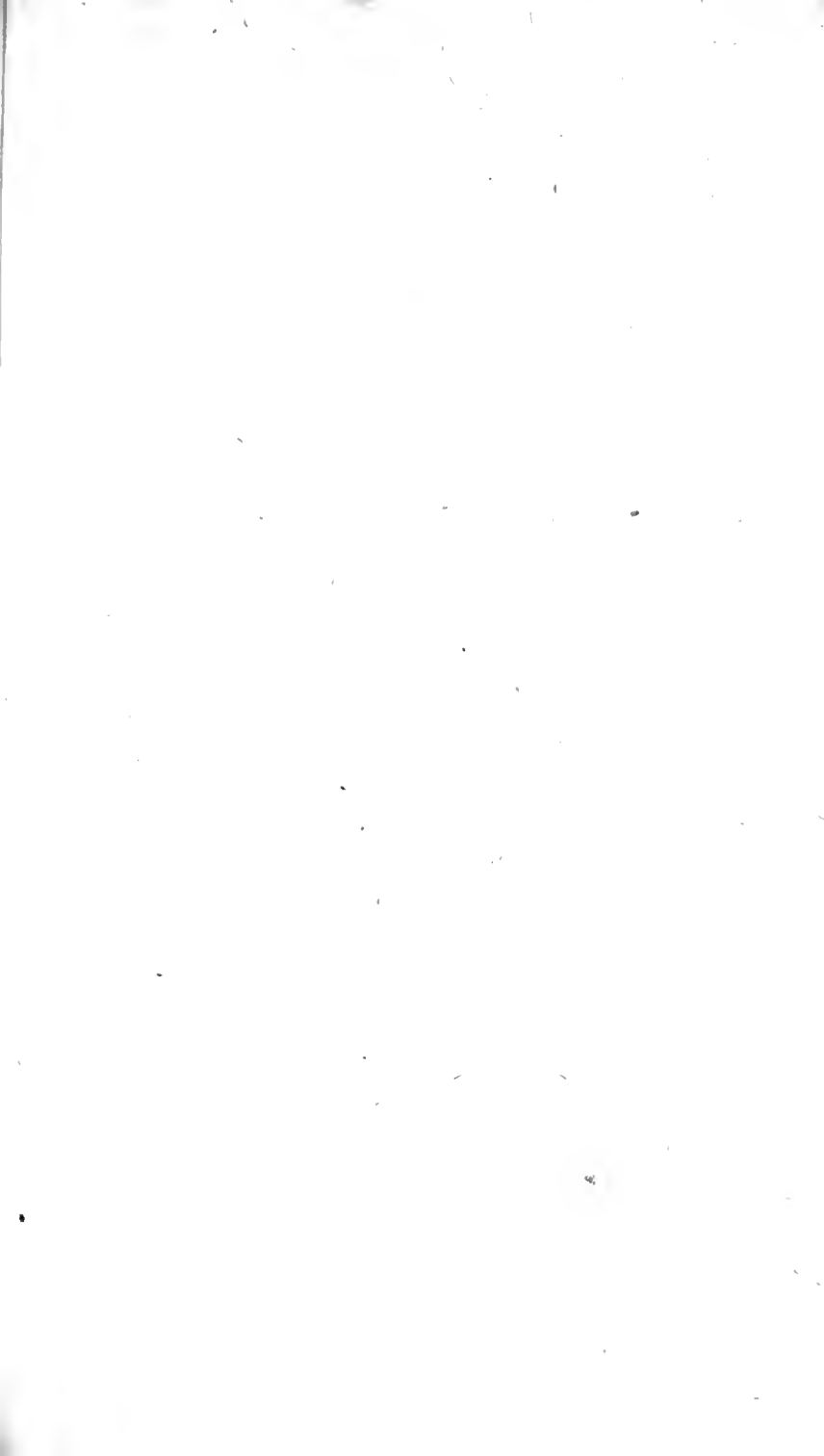
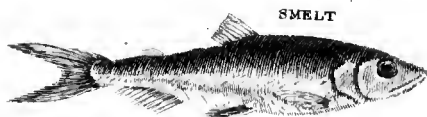
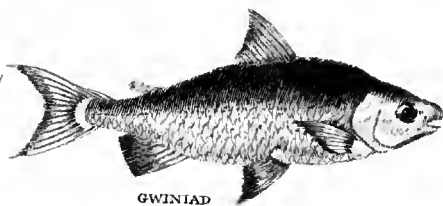
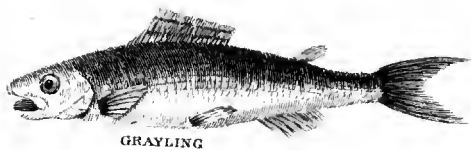
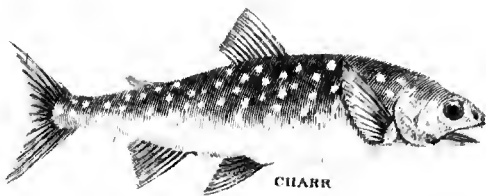


Plate XXVII.



three species, the red, and the gilt, and the case-charr. These kinds are nearly similar in their external appearance; but the time and manner of their spawning are so different, as to afford room for their specification into three distinct families. The case-charr spawns about *Michaelmas*, and chiefly in a river that runs into the lake called the *Bratby*. The spawning season of the gilt charr is from the beginning of *January* to the end of *March*: they never ascend the river; but make choice of a springy part of the lake, where the bottom is smooth and sandy*.

The figure of the charr is more slender and lengthened than that of the trout: The colour of the back is an olive green, variegated with spots of a dusky white, and others of a dull yellow. The belly is of a pale red, in the female greatly diluted, and approaching to white. The whole body is covered with very minute scales†. The manner of taking these fishes is with nets or trammels, as they are called, which are furnished with bait to allure the fish, and left set for several days, till they are known to enter them.

The Gwiniad §.

THIS fish seems to be an intermediate species between the trout and the herring; like the latter, it suddenly

VOL. III.

K k

dies.

* Brit. Zool.

† Willough. p. 196.

§ *Salmo Lavaretus*, Lin. Syst. *Lavaretus Allobrogum*, Will.

dies when taken out of the water. In length, it is nearly a foot, laterally compressed, has two fins upon the back; the first about three inches from the snout, and supported by thirteen rays; the second, which is placed near the tail, is thick, fat, and altogether without rays. It is this spurious fin which *Willoughby* assumes as the generic mark of all the fishes of the trout kind*.

This fish, like the charr, is of an alpine nature, and inhabits the lakes of the mountainous parts of *Europe*; such as, *Switzerland*, *Savoy*, *Norway*, *Sweden*, *Lapland*, and *Scotland*: Into the last mentioned country, it is said to have been introduced from *France* by the unfortunate *Queen Mary*; a circumstance rendered probable by the *French* name *vangis*, given it by the inhabitants in the vicinity of *Lochmaben*. The *British* name of gwiniad is bestowed upon it from the whiteness of its scales†. The gwiniad is a gregarious fish; and approaches the shores in vast shoals in summer and spring, which are the seasons in which it is taken: In some of the *German* lakes it is caught in vast abundance, and salted up for sale in the neighbouring towns. The flesh is insipid, and will not preserve for any time without salt.

There are twenty-nine different species of fishes belonging to this genus, of which nine species, with their varieties, are all that is known in *Britain*.

* Vide *Ichthyol.* p. 183.

† *Brit. Zool.*



Plate XXVIII.



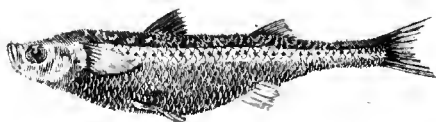
PIKE



SEA PIKE



SAURY



ATHERINE



ARGENTINE

SECTION XI.

GENUS XLVIII.—*The Pike.*

THIS tribe contains in it four species of *British* fishes; namely, the common pike, the sea pike, the gar, and the saury: They are all distinguished, by having only one dorsal fin near the tail; by a long, slender body, laterally compressed; and by the length of the lower jaw, which projects considerably beyond the upper. In general, the snout of this family is long, and flattened horizontally; the scales are small, bony, and deciduous.*.

The most remarkable part of the manners of these fishes is their voracity. Almost every kind of animal that is not too large for its swallow, is indiscriminately devoured by the common pike: even those of its own species are sacrificed to its gluttony, as often as other food is wanting to satiate its ungovernable appetite. Two instances are mentioned of its being choaked, by attempting to swallow animals too large for its power of deglutition: In the one, the animal expired in endeavouring to devour a pike nearly of its own size; the other happened at the canal at *Trentbain*, where the pike seized the head of a swan, as she was feeding under water, and gorged so much of it as killed them both.†.

K k 2

All

* Gen. Hist. pisc. gen. 43.

† Brit. Zool. gen. 34.

All writers agree in ascribing uncommon voracity to these animals, and mention facts in support of it so extraordinary, as would seem incredible, were they not in a great measure confirmed by daily observation. The peculiar structure of the jaws, which are loosely connected together, and have on each side an additional bone, like those of the viper, while it favours their voracious instincts, proves often their ruin, by prompting them to swallow morsels too large, even for that uncommon distension of which they are capable.

The digestive powers of the pike are as remarkable as its voracity: After swallowing a fish of a size but little inferior to its own, those parts that have entered into the stomach are dissolved with amazing rapidity; while those in the mouth and throat, which are yet entire, make a constant progress downwards, as the process of digestion makes way for them. Hence a fish, which is too large to be swallowed entire, appears for a while with its tail hanging from the mouth of the pike; but soon after totally disappears, and is dissolved by the stomach almost as quickly as it enters there *.

From this extraordinary voracity of the pike, aided by such uncommon powers of digestion, he is by far the greatest tyrant of the fresh water. He is said to contend with the otter for his prey, and sometimes to force it from his mouth. The angler, in drawing a trout, has been known at once to lose his line and his prize, by the unexpected attack of one of these plunderers. When we consider the numbers and voracity of these animals, it may appear strange that any of the inhabitants of the
fresh

* Willough. p. 237.

fresh water should escape their devastations. Young geese and ducklings, when they first venture into the ponds, are often destroyed by them : and all the smaller fishes shew the same terror at the appearance of the pike, as the little birds do at the sight of the hawk or the owl*.

The devastations committed by the pike are considerably increased, by the great longevity of that animal : If the accounts of naturalists can be credited, the period of its existence far exceeds that of every other fish, not excepting those of the cetaceous kinds. The *Polish* naturalist *Rzaczynski* mentions one that reached its ninetieth year†; and *Gesner* gives a print of a brazen ring, that had been affixed to one that was caught near *Hailbrun*, in the year 1497‡. On it were inscribed these words in Greek characters ; *I am the fish that was first of all put into this lake by the hands of the governor of the universe, Frederic II. in the 5th of October 1230.* According to this account, the fish must have been no less than two hundred and sixty-seven years of age, a fact too extraordinary to be received on the evidence adduced for it.

The generation of the pike, from its being found in ponds, where none were ever introduced, has been supposed as extraordinary as its longevity. Nothing, however, seems more easy than to account for these facts, on the well known principles of the generation of fishes : If a heron hath devoured their ova, and afterwards excreted them while fishing on one of these ponds, it is highly probable, that they may be produced from this original, in the same way that the seeds of plants are known to be disseminated

* British Zoology, Gen. 32.

† Hist. Nat. Pol. p. 152.

‡ Vidę Icones piscium, p. 316.

disseminated *. When the female pike is about to spawn, she is said to withdraw as much as possible from the common haunts of these fishes, that she may conceal her brood from the depredations of the rest, it being a well known fact, that the male of many species pursues the female when about to deposit her ova, and on the first opportunity devours them.

When the pike is in season, its colours are a very brilliant mixture of green, with bright yellow spots; the gills are then of a vivid and full red; when out of season, all these colours decay; the green becomes gray, and the yellow spots grow pale. It is only when in season that their flesh is eatable: it is then white, firm and palatable food. *Gesner* relates a most extraordinary method of exposing them to sale in *England*, which seems as little entitled to credit as his account of their longevity. He heard, he alleges, from an eye witness, that the animal's breast was cut up about two inches, to shew its degree of fatness, and if no purchaser offered, the wound was instantly sowed up, and the fish again committed to the pond, where, by being rubbed with the glutinous matter on the body of the tench, it was soon cured †. In some parts of *England* the pike was formerly fed in small perforated boxes of wood, fixed by chains to the banks of the river. Such floating chests *Willoughby* declares he has frequently seen in a river near *Canterbury*.

The season of generation among the pikes is in *March* or *April*, according to the heat of the weather: their fertility is extraordinary; an hundred and forty-eight thousand

* Willough, ubi supra.

† Vide *Gesner* apud *Will.* p. 238.

thousand ova being taken from a single fish caught in the *Rhine*, which did not weigh above nine pounds *.

This species of fish is common in the lakes, rivers, and ponds, over the whole of the north of *Europe*: It is, however, most numerous in *Lapland*, where pikes are said to be taken sometimes eight feet in length; and their exportation for sale forms a considerable article of commerce. The pike abounds in most of the lakes and rivers of *Britain*, and in such numbers as renders the common account of this fish being introduced into *England* in the reign of *Henry VIII.* extremely improbable †.

The *American* pike, or *Esox offeus* of *Linnaeus*, seems far more abundant in the lakes of *Canada* than ours, and forms there a most valuable article of food. It grows commonly to the size of four or five feet; it is covered all over with bony rhomboidal scales, which render it almost invulnerable; but is, notwithstanding, taken by the *Indians* in such quantities, that it forms no inconsiderable portion of their sustenance.

* Leonard. Baltnerus apud Will.

† In the Lincolnshire fens, numbers are taken in semicircular baskets, open above and below. The manner is, by letting down the basket from the end of a fen-boat, and as soon as the fish is found to have entered, it is immediately taken up into the boat.

The Gar *.

THIS fish is commonly known by the name of the sea-needle : it makes its appearance in summer, a little before the mackrel, a fish it resembles in taste as well as in the spurious fins near the tail. It is a long slender fish, flattened a little towards the belly, and quadrangular as it approaches the tail. The head is flat, projecting forward into a very long sharp snout, which is characteristic of this species. The sides and belly are of a bright silvery colour ; the back is green, marked along the middle with a dark purple line ; the sides are also each distinguished by a line running from the gills to the tail. The lower jaw projects a great way beyond the upper, and terminates in a certain soft substance : on both sides it is provided with teeth, like the common pike ; and the upper jaw is moveable as in the crocodile ; a circumstance from which the gar is distinguished from all other fishes, as well as by the superior richness and vivacity of its colours while in the water.

To this genus is commonly referred the saury, a fish not enumerated by *Linnaeus*, but described by *Rondeletius* as an inhabitant of the *Mediterranean*†. Above and below the tail there are a number of spurious fins, resembling

* *Acus vulgaris*, Aldrovand. *Eloz* Belone, Lin. Syst.

† *Pisces*, 232.

bling those of the mackrel. The jaws are produced like those of the garr, but are of equal length, and terminate in a very sharp point. The upper mandible is slightly incurvated, and the length of each is one inch. The eyes are large; the body anguilliform, but towards the tail it grows suddenly small, and tapers off into a very slender point*. Some years ago, a shoal of these fishes appeared in the *Firth of Forth*, and great numbers were cast ashore upon the sands at *Leith*, where the inhabitants called them *Egyptian herrings*.

* British Zoology, genus 32.

GENUS XLIX.—*Elops*.

THE saurus is the only species belonging to this genus; it is found in *Carolina* and in the *West Indian* seas; and in its external form nearly resembles the pike. The mouth has the same extraordinary gape; while the upper, as well as the lower jaw, is armed with teeth. The ventral and dorsal fins are somewhat larger than those of the common pike, and also placed nearer the head. The anal fin is hard by the tail, which is bifurcated.

The head of the saurus is large, and flattened horizontally; the body is slender, resembling a lance, and covered with large angular scales. The eyes are large, orbicular, and placed at a distance from each other; they are half covered with a nictating membrane. What particularly distinguishes it, is a bony scale at the origin of the caudal fin, both above and below†.

* *Elops Saurus*, Lin. Syst. *Saurus*, Slean, Jam;

† *Guan*, Hist. piscium.

GENUS L.—*The Argentine* *.

OF this genus there are two species; the one peculiar to the *American* seas, termed by *Linnaeus* the *Argentina Carolina*; and the other found in the *European* and sometimes in the *British* seas. The *European* argentine is most frequently seen in the *Mediterranean*: *Willoughby*, who examined one at *Rome*, says, that the outside of the air bladder consists of a foliaceous silvery skin, which was made use of in the manufacture of artificial pearl †.

The snout of this small fish is sharp and prominent; the body round and tapering, seldom exceeding two inches in length. The back and sides, as far as the lateral lines, are a pale ash colour, mixed with green: The belly, and parts below these lines, are exactly coloured as if covered with silver leaf. The mouth is small, without teeth, excepting some asperities resembling them upon the roof of the mouth, and the tip of the tongue. The eyes are large; the irides silvery; and on the forehead is a patch of dark purple. The dorsal fin is placed near the equilibrium of the fish, and supported with ten soft rays. There are two pectoral, two ventral, and an anal fin, near to the tail, which is bifurcated.

* *Argentina Sphyræna*, Lin. Syst. Pisciculus Romæ, *Argentina dictus*, Will.

† Willough. 229.

GENUS LI.—*The Atherine**.

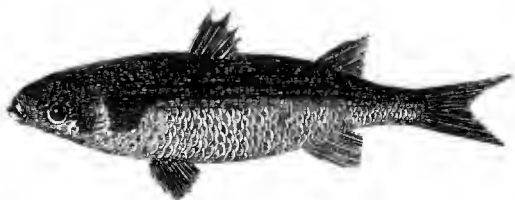
THIS tribe *Linnaeus* has divided into two species ; both distinguished by the flatness of the upper jaw, by a silvery stripe along the sides, and by having six branchiostegous rays. The atherine best known on our coasts, is very common near *Southampton*, where it is called a smelt. It is in season from *March* to the beginning of *June*, at which period it begins to spawn. It never deserts the place ; but may be taken there at every season, excepting in hard frost.

The atherine is from three to four inches in length ; and the body is semi-transparent, except where the spine, or the viscera intercept the rays of light. The shape of the body is oblong, and slender ; the back straight ; and the belly a little prominent. The belly is silvery ; the back variegated with blackish coloured spots, which become more discernable after the scales are stripped off. The mouth is large ; and its aperture, when the jaws are shut, seems to look upwards. The lips hang down : both jaws, as well as the palate, are beset with small teeth ; and upon the back are two dorsal fins.

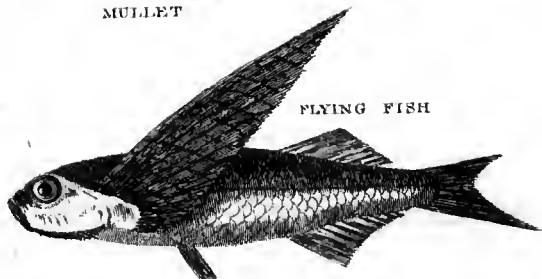
* *Atherina Hesperus*, Lin. Syst. *Pisciculus Anguella Venetiis dictus*, Will.



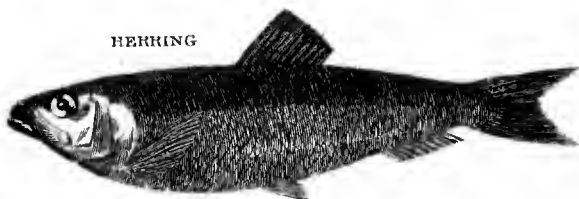
Plate XXIX.



MULLET



FLYING FISH



HERRING



PILCHARD



ANCHOVY

GENUS LII.—*The Mullet* *.

RONDELETIUS has described five different kinds of sea-mullets, which do not seem to be any thing more than varieties of the same species: *Linnaeus* enumerates only two; the sea-mullet, and the white. The former is taken both off the *English* and *Scotch* coasts. It is covered all over with large scales; the teeth are all placed upon the tongue and palate. The back, which is of a dirty green, is slightly incurvated; while the belly projects more considerably, and is of a pure white. The upper part of the fish is curiously variegated with white and black lines, proceeding in a parallel direction, from the head to the tail: The scales are also arranged in rows parallel to each other; and in the same direction. There are two dorsal fins; the first supported by spinous, and the second by soft rays; the tail is bifurcated †.

The residence of the mullet is the sandy shoals and bays, into which there is an inlet of fresh water: In such situations, they are found all round the shores of *Great Britain*, where they leave the sand all marked with round holes, the traces of their digging, for they keep constantly rooting like hogs among the mud. When surrounded by a net, the whole shoal frequently escapes by leaping over it; one attempting this mode of escape, and succeeding, is immediately followed by all the rest ‡. The

* *Mugil Cephalus*, Lin. Syst. Mullet, Willough.

† Willough. p. 274.

‡ Oppiani. Halieut.

The mullets are in great plenty in the *Mediterranean*, and along the southern coasts of *France*. In a certain lake near *Martegues*, in the south of *France*, there are vast shoals which enter there during spring, the season of copulation among these fishes; after impregnation they return to the sea, but are intercepted by weres of reeds.

Of the milts and roes of the mullet, the famous *Bostargo* of the *Italians* is made up. The materials are taken out entire, and for a few hours covered up with salt; afterwards they are pressed between two boards, dried in the sun for about a fortnight, when they are fit for use. This composition is said to brace a weak stomach, and to give an exquisite relish to wine, when ate before drinking.

The food of the mullet is mud, or sea-weed; it never attempts to devour any fish. The flesh of this animal is palatable, though at present not a fashionable dish; its flavour greatly depends on the ground where it is fed; if among mud, it constantly tastes and smells of that kind of food.

According to *Gesner**, the mullets are the most salacious of all animals; the male pursuing the female even after she is captured, till drawn ashore. At *Tarentum*, a male, pursued his female that had been caught with the hook and line, till he received several strokes with a spear, and was at last taken and drawn into the boat: By such an ungovernable desire are these animals impelled to fulfil the purpose of nature.

At *Athens*, and afterwards at *Rome*, when an unfortunate galant was caught in the company of his mistress, the mullet is said to have been employed by the enraged husband

* De Piscibus.

husband as an instrument of a shocking punishment*. *Juvenal* and *Horace* both allude to it in mentioning the various modes of revenge which rage dictated to the injured spouse †.

————Necat hic ferro, fecat ille cruentis
Verberibus; quosdam mæchos et mugilis intrat.

* *Vide* Caufabon. in Athen.

† *Juven.* Sat. x. 316. *Hor.* Sat. ii. lib. iv. 132.

SECTION XII.

GENUS LIII.—*The Flying-Fish* *.

THIS genus comprehends two kinds of flying-fish, the volitans and evolans of *Linneus*; the former is the most common kind of the winged inhabitants of the sea. Hardly* any instance occurs of either kind being found in the *British* seas†: They are frequent in the *Mediterranean*, and warmer latitudes in the *Atlantic*, where they are continually hunted by the *Dorados* while they continue in their own element; and, as often as they endeavour to escape them by ascending to the air, they become the victims of the gull or the albatross; or are by them again forced back into the mouth of their pursuers below, who have still their eyes fixed upon them, and keep pace with their flight. Thus harrassed by inveterate enemies in both elements, they often fall down upon the decks of ships as they pass, and seem to yield themselves up to man as the more merciful destroyer.

In size, the flying-fish nearly resembles the mackerel; only of a longer and more slender form: if the wings are taken away, it bears a strong similarity to the mullet;

The

* *Exocoetus Volitans*, Lin. Syst. *Mugil Alatus*, Rond.

† Vide Pennant's Brit. Zool. gen. 38.

The scales are of the same large size ; and the same dark green covers the back : the head is depressed ; the snout sharp ; the mouth small, and destitute of teeth. There is only one dorsal fin, about a fourth of the fish's length from the tail. The two pectoral fins, which are the instruments of flight, are almost as long as the body, and supported by fourteen strong branchy and jointed rays *.

The ancients were acquainted with the flying-fish, and gave it the name of sea-swallow † ; and all the different writers have taken notice of its faculty of mounting into the air by means of wings.

* Willough.

† *Hirundo* Plinii, l. ix.

GENUS LIV.—*Polynemus*.

THIS tribe contains three species, all of which are rare exotics, which never visit our seas. Their bodies are oblong, thick, and covered with scales; as is also the head, which slopes off into an obtuse snout. The jaws are of equal length when open; but when shut, the lower is longest; both are furnished with small, thick and immoveable teeth. The tongue is narrow and smooth; but the palate is exasperated with a number of sharp tubercles. The eyes are of a middle size, placed at a great distance from each other, and covered with the common tegument of the head; before them appear the two large apertures of the nose.

The sides are compressed, and the abdomen carinated; each of the lateral lines are smooth, and bend in a direction parallel to the back. There are two dorsal fins; the first spinous, and placed about the fish's equilibrium; and the second, which is larger, behind it. The pectoral fins are long and narrow; the ventral are placed in the abdomen; the tail is large, broad, and bifurcated.

GENUS LV.—*Mormynis* *.

THE fishes of this genus are only two, and both strangers to our shores: Their generic characters, an oval body compressed at the sides, and narrow towards the tail: The snout protuberant; and the opening of the mouth very small and rough, with a few setaceous teeth placed on the extremity of the jaws. The back has a large swell, and from it rises one dorsal fin; the pectoral fins are small, and situated near the belly; the anal fin is behind the equilibrium, and that of the tail bifurcated †.

* Le Mormyre, Guan. Mormyrus, Lin. Syst.

† Guani Hist. pisc. gen. 50.

GENUS LVI.—*The Herring* *.

MANY of the fishes of this genus are well known. Some of them, such as the herring and pilchard, constitute a larger portion of the food of the human race, than perhaps any fish whatever. The herring fishery, which forms so considerable a branch of commerce to the *English*, *Dutch*, and other nations of the north of *Europe*, is a modern invention. Those myriads of fish which annually teem from the *Arctic Seas*, and which are the objects of this fishery, are supposed to have been altogether unknown to the ancients; for there is no word which seems to have been appropriated to this most numerous species.

The external characters of the herring are so well known, that all description of them would be superfluous. The grand winter residence of this fish is within the arctic circle, where insect food abounds in a still greater degree than in warm climes. The particular food, however, of these fishes has not yet been perfectly ascertained: The intestines are filled commonly with a blackish mud, apparently too much digested to discover exactly its nature; it is supposed to be a crustaceous insect †.

From the *Arctic Seas*, the herrings annually migrate along the shores of *America*, as far as *Carolina* ‡; along
those

* *Clupea Harengus*, Lin. Syst. Herring, Will.

† *Oniscus Marinus*, Lin.

‡ *Catesby Carolina*, II. 33.

those of *Europe*, as far as the north of *France*; and on the east of *Asia*, they are found on the shores of *Kamschatka*. The great army that annually issues from the north, separates into several divisions: The first makes its appearance off the *Shetland Isles* in the months of April and May; but these are only the harbingers of a far more numerous body, that follows in June. The appearance of these shoals is always announced by the gulls, gannets, and other rapacious birds, that continually hover above them; but when the great body approaches, about the beginning of Harvest, its breadth and depth alter the appearance of the ocean, which sparkles with various colours, like a bed of precious stones, by reflecting the rays of the sun from the scales and fins.

When the herrings first quit the regions of the *Frozen Sea*, they are divided into different columns, of five or six miles in length, by three or four in breadth; and in their progress southward, the first obstacle in their way is the *Shetland Islands*, by which they are separated into two grand divisions; the one advancing along the whole *British* coast, filling every bay and creek, till it reaches the *Channel*, after which it gradually thins, till it disappears. The other great wing makes a similar circuit round the west coast, till it reaches the north of *Ireland*, where it is again subdivided; part entering the *Irish Sea*, and part scattering along the west shores of *Ireland*, till it disappears about the entrance of *St. George's Channel*.

Several stationary fisheries are established on the west of *Scotland* and *Ireland*; but the herrings are by no means uniform in resorting to the same loch or bay annually. They frequent a certain space for a number of years, and then capriciously desert it for perhaps as many more. On the coast of *Wales*, and among the *Hebrides*, they

they have at different times occupied and deserted their several stations, without any apparent cause. But although this stupenduous gift of the munificent Author of Nature, is at times partially distributed, it is never totally withdrawn. The same instinct invariably operates; and if one part is deprived of its effects, another teems with plenty, and relieves the necessity of such as are less liberally supplied: Thus, thousands of the poor are annually supported, and rendered happy, by that instinct which the Almighty hath originally impressed upon this useful part of his creatures*.

But this appetite for migration, which brings the herring annually to our shores, serves also purposes of the greatest importance in the economy of these animals: It leads them to the shallow and tepid waters of the temperate zone, to deposit their spawn, where it is matured and vivified with greater certainty than in the midst of the frozen ocean.

The multiplication of their kind, is, therefore, perhaps the primary purpose of nature in the migration of the herring. It is not from a defect of food that they abandon regularly their northern retreats; for it is immediately after leaving these, that they are most plump: before their return, they are greatly reduced by spawning, and are then thin and miserable. The time of spawning is from the beginning of winter till January, when they almost totally disappear from our coasts, or are taken in small straggling parties by the fishermen, for the purpose of bait. It is probable, that at the time they abandon our seas, they again repair to the north, to restore their
vigour,

* Brit. Zoology, Gen. 39.

vigour, and, by impregnation, to replace that immense waste, which the exertions of man, and the rapacity of fishes, has made of their species.

The spawn, after being discharged by the parent fishes, continues to float on the waves for a considerable part of the Spring. In the beginning of Summer, the young enter upon life, and in June and July are seen in vast numbers approaching the shores. They are then about two inches in length, and most probably feed upon insects, as thousands have been caught a little after that period with the common trout fly. Along the *Yorkshire* coast, these young fish are called *file*; upon that of *Scotland*, they obtain the general name of *fry*, which seems to be applied indiscriminately to the young of all fish. During winter, it is probable that the young herring retire to the north, along with the old. On their appearance next summer, although the shoals are made up of fish of very different sizes, it does not appear that they are then distinguishable from the fish of greater age.

The *Dutch*, who have set the example to the other nations in almost every thing relating to commercial industry, first commenced the herring fishery in 1164 *; and continued in the exclusive possession of it for several centuries. At length the *English*, roused by their gains, and jealous of that naval power of which it was the grand source, endeavoured to participate in this lucrative commerce, and for that purpose fought many well disputed battles. The superior industry and experience of the *Dutch*, always have, and probably long will, secure them the greatest share of this trade. The most considerable stations of the *British* fisheries are off the *Shetland* and *Western*

Western Isles, and off the coast of *Norfolk*; in all these stations the *Dutch* ships are ever ready to take their share.

One *William Beukelen* of *Biervolet*, near *Shuys*, was the inventor of the useful expedient of *pickling* herring; and it is from him the operation has its name, both in the *English* and *German* languages. This great benefactor of mankind died in 1397; and his memory was held in such veneration by the Emperor *Charles V.* that he paid a visit to his tomb. The *Dutch*, it is said, are remarkably fond of the herring in its pickled state: A premium is given by the state to the first *buys* that arrives loaded with a cargo; which sells them for a very high price. The whole inhabitants welcome the arrival with shouts of exultation; and the same joy seems painted on every face, which the *Egyptians* display on the first overflowing of the *Nile* *.

The Pilchard †.

THE pilchard, in some respects, resembles the herring; it is remarkable for similar migrations, and stated returns from the north. As this fish is far from being so general as the herring, appearing only on the coast of *Cornwall* for a short time in the end of Summer, we shall give a short description of its external figure.

3

Its

* Idem, ubi supra.

† *Clupea* de Artedi. The Pilchard, Will.

Its ordinary size does not exceed nine inches; the body is a little thicker in proportion than that of the herring, and the belly less sharp: The scales are very large, thin, and rounded; the back is bluish; the sides and belly silvery; the head is compressed, and the mouth without teeth. The upper angle of each of the gills is marked with a large black spot; some have four or five such spots disposed in a row near the tail; the lower edge of the belly is serrated, owing to the row of large clypeiform scales that runs along it.

The pilchard annually appears in large shoals off the *Cornish* coasts, from whence it is regularly exported in great quantities into the *Mediterranean*. The fishing season is from June till the beginning of Winter; a few sometimes are found hovering about till Christmas. There are spies, or *huers*, as they are provincially called, stationed on the cliffs that project into the sea, whose business it is to watch the progress of the shoals, and to give notice to the boats below of the measures they are to take, by means of signals previously agreed upon.

By an act of *James I.* these huers are empowered to go over the grounds of others, without being liable to damages*. By their motions the nets are both shooted and drawn; and when they have been successful in inclosing part of a shoal, an hundred thousand are sometimes taken at a single draught. In October 1767, there were at one time inclosed in the Bay of *St. Ives*, seven thousand hogheads, or two hundred and forty-five millions of fish. The average amount of the export of these fish appears to be 29,795 hhds. annually; which, including the bounty paid by government, and the price of the

* Cap. 23.

oil extracted from them, are sold for about forty-nine thousand pounds.

But the great benefit arising from the pilchard fishery, is the employment it affords to a number of seamen, which are thus trained up for the defence of the nation. A variety of hands, too, are employed on shore, in the different operations of salting, pressing, washing, and cleaning the fish, as well as the trades people, who depend upon the construction and sale of boats, nets, ropes, and casks *.

The Anchovy †.

THIS species is taken in the *Mediterranean*, and exported, pickled, to the different nations of *Europe*. Before salting, the head and viscera are taken away; and in this state they are ate raw, with vinegar and oil. They are supposed to give wine an excellent relish; but probably their chief merit consists in bracing the stomach, after being relaxed by excessive drinking.

Near a century ago, the anchovy was found at the mouth of the river *Dee* ‡; and since that time has hardly ever been deemed an inhabitant of our seas. The length of this species is from four to six inches; the body slender, but thicker in proportion than that of the herring: The eyes

* Borelase's Cornwall.

† *Clupea encrasicolus*, Lin. Syst. Anchovy, Willough,

‡ Ray's Letters, 47.

eyes are large ; the irides white, with a cast of yellow ; the under jaw much shorter than the upper ; the teeth small ; a row in each jaw, and another on the middle of the tongue. The scales are large and deciduous ; the back green, and semipellucid ; the sides and belly silvery and opaque ; the edge of the belly smooth, and the tail forked.

The genus of herrings, according to *Linnaeus*, contains eleven species ; among these, however, the pilchard is not enumerated ; although, from its history, we have seen that it is one of the most common, and perhaps the most numerous, fish upon our coasts.

The sprat is also a very common species belonging to this genus, which *Willoughby* and *Ray* have supposed to be the fry of the herring. It nearly resembles the anchovy in size and shape ; but from the time of its appearance on our coasts, it seems to be a distinct race from the herring. These fish come into the river *Thames* in the beginning of November, and continue there till March ; a season when the herring have long retired into the North Sea. During the whole of the Winter season, they constitute a large portion of the food of the citizens of *London*. At *Gravesend* and *Yarmouth*, they are cured like red herring, and sometimes pickled like anchovies ; from which they differ but little in their flavour.

The Shad *.

THIS is supposed to be the thrissa of *Aristotle* and *Oppian*, and the alaupa of *Ansonius*; but the descriptions which the ancients gave of their species were so vague and general, that we can seldom ascertain the exact species they had in view. The shad, in the shape of the body and head, bears a strong resemblance to the herring; the former, however, is a deeper fish, and more compressed laterally; it is also considerably larger, weighing from four to eight pounds. In colour, this species resembles the pilchard; the back being of a blackish blue, and the sides silvery. On each side, near the gills, there is a large black spot; and behind it, in the same straight line, there is a row of five or six others, smaller in size. The lateral lines are obscurely discerned; the scales are large and deciduous, their margins punctuated with small black dots; the belly is carinated, and strongly ferrated by the edges of forty scales, which proceed in a row, from the gills to the anus. The eyes are large, covered as far as the irides with a loose membrane; the upper jaw is somewhat shorter than the lower, and exasperated on the margin with very minute teeth; the other parts of the mouth are smooth. The dorsal fin is situated near the centre of the fish, supported by eighteen cartilaginous rays, of which the middle are longest; the ventral, pectoral,

* Clupea Alopa, Lin. Syst. The Shad, or mother of herring. Will.

toral, and anal fins are small in proportion to the fish's size; and the last is placed very near the tail, which is greatly forked *.

The *Severn* produces the shads in higher perfection than any other *British* river. They appear there in April or May, according to the warmth of the Spring; and after two months they disappear, and are succeeded by other varieties of the same fish. About *Gloucester*, the shad is esteemed a great delicacy; it is there caught in nets, and sold at a price as high as that of salmon. It is from thence they are sent to the *London* market, where they are distinguished from the shad of the *Thames*, by the *French* name *alose*.

It is not ascertained where the shads spawn: at the time of their mounting the river, they are in full roe; but none are caught on their return to the sea, after shedding their spawn †. The bleak, which are caught in the *Severn* in the months of *July* and *August*, are erroneously supposed to be the young of this species. The shad is found at certain seasons in the river *Nile*; it is there, as well as in *England*, a fish of passage ‡; it is also seen in the *Mediterranean* near *Smyrna*, and on the coast of *Egypt*, in the neighbourhood of *Rosetto*.

This species was reckoned very mean food by the ancients; *Ausonius* characterises it as the food of the poor §. Those of the *Thames* agree to his description, being a very insipid and coarse fish. *Jovius* gives a similar account of this animal as an article of food; but asserts that it improves after ascending the *Tiber* ||. In the

* Willough. page 227.

† Belon, 307.

‡ Belonii Itiner, 98.

§ Stridentisque focis obsonia plebis Alaufas; Mosella, 128.

|| De Piscib. Roman.

the *Severn* there is a variety caught near *Glocester*, called the *twaite*, which is equally disesteemed with the *Thames* shad. These varieties are distinguished by their size, the *twaite* being nearly one half smaller than the true shad; and has always fewer black spots behind the gills*.

* British Zoology, Gen. 39.

SECTION XIII.

GENUS LVII.—*The Carp.*

LINNÆUS makes this genus consist of no less than thirty-one different species; analogous indeed in their external characters, but differing considerably in their habits and economy. They are all of an oblong and oval shape; the body laterally compressed, and covered with large imbricated and deciduous scales. The mouth is small, and destitute of teeth; hence they have been denominated leather-mouthed fishes. They are all distinguished by three branchiostegous rays, and one dorsal fin rising from the middle of the back, which is convex, and somewhat carinated.

The nostrils are covered with valves, by which they are alternately opened and shut; and the greater part of the genus have *cirri*, or beards, round the mouth. Some of these fish were brought to *England* from the south of *Europe*, and are now naturalised in our fresh-water ponds.

The Carp *.

THIS species was introduced, according to *Fuller*, into *England* in the year 1514, by *Leonard Mascall*†; but before that time, we read a description of it in the book of *St. Albans*, printed in 1496. It is by means of transportation that they have been naturalised in most countries of *Europe*, as is the case in *Sweden*, *England*, and *France*. They have not yet found their way into *Russia*, though *Polish Prussia*, which is probably their native country, is at no great distance: There they abound in all the rivers and lakes, and are taken of such vast size, that they have become a valuable article of commerce. The merchants purchase them from the lakes and rivers belonging to the *Polish Noblesse*, and transport them in well-boats to *Sweden* and *Russia*. In imitation of them, some of the *English* gentry have begun to turn their fishponds to account, by regularly selling their carp‡.

The carp is, perhaps, the most remarkable among the spinous fishes for longevity: An instance is recorded of one in the palatinate of *Germany*, that lived an hundred years in the *fossee* surrounding a fort ||. Their size in some countries is said to correspond to this extraordinary longevity; several being taken in the *Lacus Larius*, of two hundred

* *Cyprinus Carpio*, Lin. Syst. La Carpe, Belon.

† British Worthies, Suffex, 113.

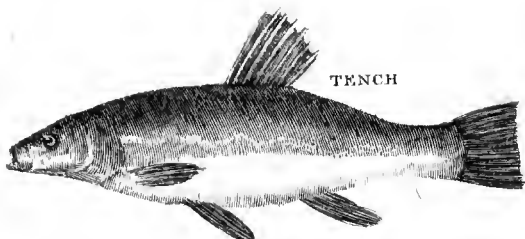
‡ Brit. Zool. gen. 40.

|| Gefner de piscib. 312.

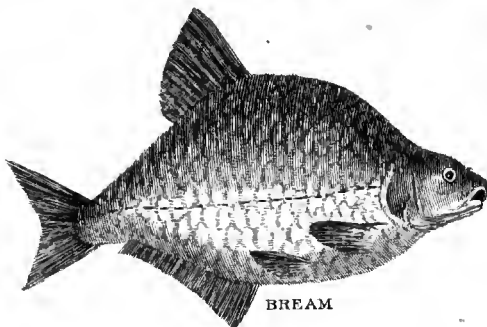
Plate XXX



CARP



TENCH



BREAM



CHUB



hundred pounds weight ; while those of the *Dnieper* sometimes arrive at the enormous length of five feet *.

Of all the finny tribe, the carp is most tenacious of life: when placed in a net wrapped in wet moss, and hung in damp cellars, it will subsist for a fortnight †. This fact is so well attested by experiment, that a method of fattening this fish has been adopted, which is founded upon it. The net is from time to time dipped in water, and the fish crammed with wheat-bread soaked in milk ; and by this management, it becomes in a short time not only much fatter, but of a far superior flavour to those fed in the pond ‡.

The fishes of this species being in some measure domesticated, their manners and economy have been more narrowly examined than most of the other tenants of the water ; and the ascertaining their fecundity has been the result of these observations : The carp is prodigiously prolific ; its belly being almost at all seasons distended with a roe, which sometimes increases before parturition, to the full size of the fish who carries it ; and when weighed opposite to it, has often been known to preponderate. Upwards of two hundred thousand ova have been numbered in one roe || ; and, if we may credit *Aristotle*, this immense offspring is produced five or six times every year §. Such is the kind attention bestowed by nature in preserving this useful class of animals, for the support of other portions of her innumerable family !

The carp, like most other species, frequent the shallow water at the season of spawning ; when a dozen of males

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O o

are

* Jovius de pisc. Rom. 131.

† Hist. Nat. Pol. 142.

‡ Derham's Physio. Theol. Ed. 9. p. 7.

|| Phil. Transact. 1767.

§ Hist. Animal

are seen pursuing one female as she emits her ova ; and upon these they eject their smelts : by which operation naturalists suppose that impregnation is effected. In this uncertain process, however, many of her ova must be dissipated in the water, without coming into contact with the *sperm* of the male ; and hence that fertility is abridged, which would otherwise soon overstock the whole waters upon the globe.

Among all domesticated animals, the purity of their manners is vitiated ; and mixed races are produced by an unnatural connection between different species : This is exemplified by the horse and the ass, by the different species of dogs, and by many of our domestic poultry ; the carp and tench, in their confinement in ponds, are also said to mingle their spawn, and to transmit an ambiguous race to posterity : In similar circumstances, the carp and bream, are reported to “ overstep the modesty of Nature,” and to violate those laws which she has so generally established between kindred tribes.

The flesh of this species is rather insipid and soft, but varies greatly, according to the place where the fish is reared, and the nourishment with which it is fed : Those in stagnated water are seldom found so well flavoured, as they that are taken from a pure and rapid stream. Of the roe of this fish a caviare is made for the *Jews*, who abominate this, and every kind of the sturgeon.

The carp is extremely shy in taking a bait, and, for this reason, the more common method of taking it in rivers is with the net. Its cunning is displayed by the various methods it practises to elude this instrument of destruction : Sometimes it leaps over the net ; at others, immerses itself so deeply in the mud, that it is drawn
over

over it : At the spawning season, all this artifice seems to forsake the animal, and it becomes then so simple, that it suffers itself to be tickled, handled, and caught, by any person that will attempt it*.

This fish, when young, is of a dusky colour, growing yellow as it increases in years : The body is of a thick shape ; the scales remarkably large ; and when the fish is in season, of a fine gilded hue. The mouth is surrounded by fat, fleshy lips, of a yellow colour ; at the angle of the mouth there is a single beard, of a yellow colour, and above it another, shorter, black, and less observable. The carp has no teeth ; their office is supplied by two smooth triangular bones, above and below, which are placed at the entrance of the throat, and by acting against each other, comminute the food before it passes downward. The dorsal fin extends far back, almost reaching the tail, which is bifurcated. Opposite to it is the anal fin, the third ray of which, as well as that of the dorsal, is strong, and armed with sharp teeth, that point downwards.

The Barbel†.

THIS species is longer and more tapering in its shape than the perch ; being from a foot to eighteen inches in length : In the *Nile*, it sometimes weighs twenty pounds.

O o 2

The

* British Zoology, gen. 40.

† Barbus, Rondel. Cyprinus Barbus, Lin. Syst.

The colour of the back is a pale olive; the belly is silvery, and proceeds without protuberance, nearly in a straight line; so that, when touching the bottom, the mouth at the same time reaches the ground. The head is sloping, the snout somewhat pointed; and on the summit of the rostrum there are two beards; other two spring from the sides of the mouth; a circumstance from which this fish derives its name almost in every language. From the middle of the back, which is a little arched, there rises one dorsal fin with ten rays, of which the first is the largest. The tail is bifurcated, and between it and the anus there rises another fin supported by seven rays*.

The flesh of the barbel seems to have been held in no estimation among the ancients: *Ausonius* alone mentions it, and, without any commendation, excepting that it improved by age†. It frequents the still and deep parts of the *British* rivers, where it lives in society, and roots like a hog among the sandy banks. The *Danube* is famous for the resort of this fish; it is there found in the caverns of the rocks, and holes under the banks, in numbers that defy all computation. The peasants take them with their hands, in quantities sufficient to load a waggon‡. Those in our rivers are characterised by the same tameness and insipidity; they are often taken with the hand, by diving: In summer they move about in quest of food; but during autumn and winter, they confine themselves to the deepest holes. The poorer peasants alone, and that from hard necessity, are constrained to eat them boiled with a piece of bacon. They are deemed the coarsest of all fresh

* Willough. p. 259.

† ——— Tibi contigit uni

Spirantum ex numero non inlaudata senectus.

‡ Albertus.

fresh water fish: their roes are even held poisonous; for they affect those who unwarily eat them, with a nausea, vomiting, and purging*.

The Tench †.

THE tench is unnoticed in the writings of all the ancients before *Ausonius*; and by him it is mentioned in such terms of disrespect, as shews the capriciousness of taste;

Quis non et virides vulgi solatia *Tincas*
Norit?

Willoughby mentions the insalubrity of this fish, on account of which, it was unanimously condemned by the medical people of his time; he denies, however, that it is ungrateful to the taste; posterity have been of the same opinion, and have gratified their palates with it without feeling any bad effects.

The residence of the tench is either in stagnated or running water; although it is taken in the *Tiber*, a pretty rapid stream, it seems to have migrated there from the adjoining lakes ‡. There is said to exist a wonderful

* British Zoology, gen. 40.

† La Tanche, Beion. *Cyprinus pinna* ani radiis 25. Lin. Syst.

‡ It is now naturalised in England, where it has been imported from its native lakes in the south of Europe. We have already noticed with regret, that the ingenuity of man has made so little progress in the domestication of fishes; this and the carp being the only species of near five hundred, that have been brought into that state.

ful friendship between this animal and the pike *, a fish which, though it devours every other, will not offer violence to the tench, on account of its healing quality. It has hence been called the physician of the fish; the slime of its skin being of a healing nature, an inhabitant of the water is no sooner wounded, than the physician is at hand with a powerful styptic :

Close to his scales the kind physician glides,
And sweats a healing balsam from his sides †.

The *Jews* practising physic at *Rome*, are said to apply the half of a tench, after being cut up, to the soles of the feet, when their patients are seized with violent fevers ‡; we believe, however, that the medical virtues of this fish, either while dead or alive, never existed but in the imaginations of the ignorant and credulous.

The tench spawns in spring, and in the beginning of summer; it is superior in fertility to the carp, near four hundred thousand *ova* having been numbered in a single roe. The young fry are remarkably quick in their growth; a circumstance the more credible, because they devour mucus and every kind of filth with avidity. The most proper bait for them is small earth worms: according to the present fashion of eating, they are deemed wholesome and delicious food.

The tench is thick and short in proportion to its length; the scales are very small, and covered with slime: The colour of the back is dusky; the dorsal and ventral fins of the same colour: The head, sides, and belly, are of a greenish cast, most beautifully mixed with gold, which
is

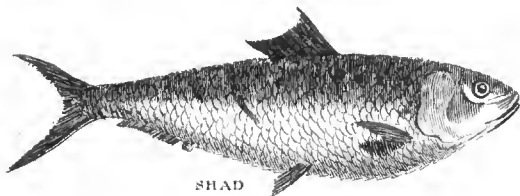
* *Salvianus apud Will.*

† *Diaper's piscat. Eclogue, ii.*

‡ *Jovius de piscib. Romanis.*



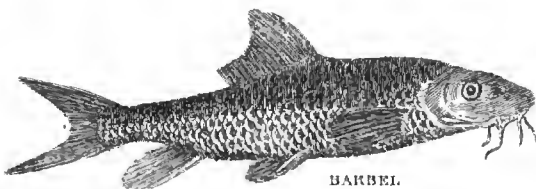
Plate XXXI



SHAD



WHITE BAIT



BARBEL.



GUDGEON



MINOW

is in its greatest splendor when the fish is in its highest season*.

The Gudgeon †.

THE gudgeon, according to *Willoughby*, is preferred by the *English* to most of the river fish; it is taken in gentle streams, and is generally of a small size, measuring only about six inches: In the *Kennet* and *Cole*, they are of superior bulk to those of every other place, and sometimes weigh half a pound ‡. They are assembled by raking the bed of the river, which makes them crowd in shoals to the spot, expecting food from this disturbance.

This species is mentioned by *Aristotle* ||, and is therefore probably an inhabitant of the rivers of *Greece*: We know from the accounts of travellers, that it is found in *Syria*§; and thus exhibits a remarkable instance of the capacity of fishes to accommodate themselves to different climates. River water must always correspond with the temperature of the country through which it flows; while that of the sea is of a much more equal heat in different latitudes; and hence we find sea fish travelling into a greater variety of latitudes than those of fresh water.

There

* British Zoology, gen. 40.

† *Gobio Fluvialis*, Rond. *Cyprinis pinna ani radiis 2.* Lin. Syst.

‡ Brit. Zoology, ubi supra. || Lib. viii. cap. 19.

§ Dr. Russel, p. 75.

There are two species of the gudgeon, a larger and a smaller; the former is an inhabitant of our rivers, the latter of those of *Germany*, where it is called wapper. The *British* gudgeon upon the back is dusky; the belly of a dirty white: It is distinguished by nine or ten large spots of a blackish colour, upon the lateral lines; others of a smaller size, being irregularly scattered over the back and fins.

At the angle on each side of the mouth, there is a small beard of a quarter of an inch; near the eyes are two large apertures of the nose: Neither jaw is furnished with teeth; but at the entrance of the throat there are two triangular bones, that perform the office of grinders, resembling those of the carp. There is a single dorsal fin, with nine rays; the pectoral have each fourteen, and the ventral eight or nine; the tail is bifurcated.

The Bream.*

THE bream is one of the fresh water fish, in no high reputation; its flesh is soft and insipid. It is of a rhomboidal shape, and in the lakes of *Italy* is found sometimes three feet in length, by two in depth. The back is greatly arched, and the sides strongly compressed: The lateral lines which proceed from the gills, are bent downwards,
curvated

* *Cyprinus Brama*, Lin. Syst. La Breamme, Belon.

curvated like a bow, and nearer to the belly than the back of the fish: above, the bream is a blackish green, the sides and belly white, with a gilded line when the fish is in high season*.

Stagnated water, or rivers gently gliding along, are the residence of this species; which there feeds upon herbs, mud, and clay. Its season of spawning is in the month of May; at which period the males are marked upon the head with a number of white tubercles; an incident which *Pliny* takes notice of as befalling the fishes of the *Lago di Como* in *Italy*†.

Similar to the bream is the rud, a fish frequent in the *Rhine*, the fens of *Holderneffe*, and in the *Charwell*, near *Oxford*. It is about two pounds weight; and in season, almost the whole year round, except in the month of April, when it spawns. At this season, the head of the male is rough with white tubercles, resembling those of the preceding species. The rud is reckoned a superior dish to any of this genus.

The rud seems to be an intermediate species between the carp and the bream; it is broader than the former, and deeper than the latter fish. The colour is brown, changing into yellow; the fins are of a reddish hue, and the whole body is covered with very large scales. The opercula of the gills are, for the most part, marked with a blood-coloured spot.

In many of the fish ponds about *London* and in the south of *England*, there is reared a fish called the crucian§; but as it is not mentioned by *Willoughby*, it is probably not a na-

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tive

* Willough, p. 248.

† Lib. ix. cap. 18.

§ Cyprinus Carassius, Lin. Syst.

tive of our rivers. The colour of this species is a deep yellow; as an article of food, it is held in little estimation. It is very deep and thick, the back much arched, and the dorsal fin supported by nineteen rays; the first two strong and serrated.

The Roach *.

THE roach, like the other fish of this genus, frequents the still or stagnated waters; it is an excellent pond fish, not only thriving well in artificial sheets of water, but replenishing them sooner than any other species, with a numerous race of inhabitants. Its offspring are not so numerous as those of the carp or tench; this extraordinary fertility must therefore be owing to a smaller number of the young perishing before they arrive at their adult state.

The roach is smaller than the bream; the shape of the body, like that fish, is deep and laterally compressed, being four inches broad by twelve long. The back is dusky, with a shade of green; the belly pale; the ventral and anal fins are a cinnabar colour, the dorsal and tail fin having less of the red †. The scales are of a silver hue, broad and deciduous. The lateral lines are curved, and run parallel to the swell of the belly: The tail is bifurcated.

The

* *Cyprinus Rutilus*, Lin. Syst. *Leuciscus*, Rondel.

† Willough. p. 262.

The dace * haunts the same places as the roach; like it, too, it is a great breeder, very lively, and during summer, fond of gamboling on the surface of the water. Its colour is a mixture of brown and yellow; the scales are smaller than those of the roach; the length of this fish is seldom above ten inches.

The graining is a fish so nearly resembling the dace, that perhaps it may be considered merely as a variety: The usual size is from six to eight inches; it is caught in the *Mersey* near *Warrington*.

The Gold-fish †.

THIS species was first introduced into *England* from *China*, in 1691; and that specimen having been destroyed, they were again imported about thirty years ago in a considerable quantity. From that time they have multiplied greatly in the neighbourhood of *London*, and from thence have been gradually dispersed over the rest of the kingdom, where they now breed as freely in the open water as the carp.

The most beautiful species of these fishes are kept in *China* for the amusement of people of rank. They are confined in small porcelain vessels, and placed in the courts to decorate the entrances of the houses belonging

P p 2

to

* *Cyprinus leuciscus*, Lin. Syst.

† *Cyprinus Auratus*, Lin. Syst. Kin-yu, Du Halde Hist. China.

to the nobility. The beauty of their colours and lively motions, give great entertainment, especially to the ladies, whose pleasures are extremely circumscribed, from the cruel policy of that people *.

In shape, these fishes bear a great resemblance to the carp; and in their native lakes they are perhaps not greatly inferior in size; for they are said to equal our largest herring †. Beautiful coloured drawings of them have been executed by *Edwards* ‡; their prevailing colour is gold, of a most amazing splendour; there are varieties marked with fine blue, brown, and bright silver; the most beautiful are said to be taken in a small lake in the province of *Che-Kyang* ||.

The Chub ¶.

THERE are five species, or rather varieties, of this fish enumerated by *Willoughby*, after the ancient naturalists: That fish known in the *English* rivers does not grow to a large size, seldom exceeding five pounds. The chub is a very coarse fish, and full of bones; it frequents the deep holes of rivers, and, during summer, commonly lies on the surface, beneath the shade of a tree or bush. It is a very timid fish, sinking to the bottom on the smallest alarm, even at the passing of a shadow, but soon resumes

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its

* Brit. Zoology, gen. 40.

† Vide Du Halde, p. 316.

‡ P. 209.

|| Brit. Zool. ubi supra.

¶ *Cyprinus Cephalus*, Lin. Syst. *Cephalus Fluvialis*, Rondel.

its situation. It rises to a common trout fly, and feeds on worms, caterpillars, grasshoppers, and other coleopterous insects, that happen to fall into the water*.

The body is longer than that of the carp; the head flattened; the back of a dusky green; the sides and belly silvery, with a shade of a gold colour, if the fish be old and in high season. The scales are remarkably large and angular, like those of the carp; the mouth is of a moderate size, round when the jaws are opened, and wholly destitute of teeth. The number and disposition of the fins resemble those of the other fish belonging to this genus; the tail is forked.

The Bleak †.

THIS species is frequent in the *English* streams, as well as those of the *Continent*. According to *Aufonius*, the taking of these fishes was anciently the amusement of children, as that of the following species is at present ‡. The flesh is soft, and destitute of fat, making no very commendable morsel.

They are at some seasons apparently seized with a disorder, which seems to occasion them great agony: They are then seen tumbling about near the surface of the water, and are incapable of swimming far from the place; but

* Brit. Zool. Species 175.

† *Cyprinus Alburnus*, Lin. Syst. *Alburnus*, Rondel.

‡ *Alburnos prædam puerilibus hamis*.

but in about two hours they recover and disappear. When thus affected, the fishermen on the *Thames* call them mad bleaks. *Pennant* imagines, that they are then troubled with a species of hair worm, which *Aristotle* observed to infest some other kinds of fish *.

It is of the silvery scales of this species of fish, that artificial pearls are made; an art which owes its origin to the *French*, and is by them carried on to such an extent, that one artist in *Paris* used thirty hampers of fish in this manufacture, during the space of a single winter. The scales are beat down into a fine powder, then diluted with water, and introduced into a thin glass bubble, which is afterwards filled with wax.

The minnow is a beautiful small fish, about three inches in length, and scarcely half the size of the bleak; it frequents most of our pure gravelly streams, and is always gregarious. It has no teeth; and the scales are so small, that they are almost invisible. The back is a dark olive colour; each side beautifully adorned with a lateral line of bright gold. The colour of the sides and belly varies; in some it is white, and in others yellow; in some it is of a rich crimson. Taking the minnow is one of the favourite, and perhaps most innocent amusements of children. This first essay at angling is performed with a bended pin, baited with a small earth worm.

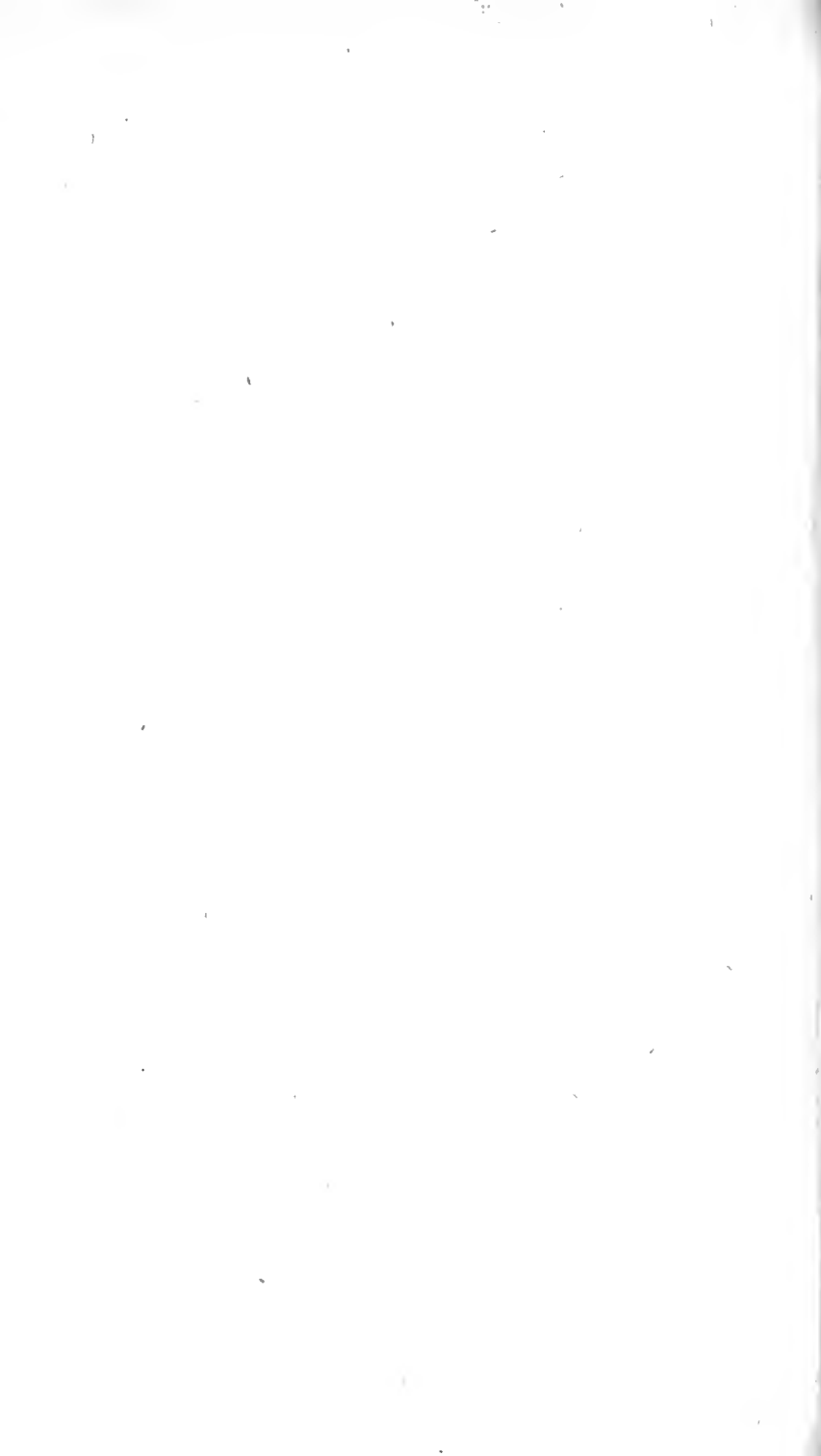
During the month of June, there appears in the *Thames*, near *Blackwall* and *Greenwich*, a fish evidently of this genus, called the white bait. No naturalist has yet determined to what particular fish it belongs, though all are agreed, that it is the young of some species that resorts there. Some have ascribed its origin to the shad; others to the sprat, the smelt, and the bleak. These fish,
however,

* Brit. Zool. Species 176.

however, are all found in other streams, while the white bait is peculiar to the river *Thames*.

The white bait has a greater similarity to the bleak than any other fish; the number and disposition of the fins are the same; and the body is compressed on the sides, in the same manner. The usual length of this small species is two inches; the dorsal fin is placed before the equilibrium; so that, when suspended by it, the tail sinks down. The tail is forked, and black on the tips. These small fry are usually caught for the purpose of bait for other fish; when fried with flour, they are reckoned a delicious viand by the lower order of epicures, who frequent the taverns contiguous to the places where they are taken *.

* Brit. Zool. Species 176.



NATURAL HISTORY

OF

INSECTS.

CHAPTER I. OF INSECTS IN GENERAL.

SECT. I.—*General idea of the number and variety of Insects : Inducements to the study of Entymology. History of this Science.*

WE are now to enter upon that department of Natural History which treats of Insects ; by the study of which, we are conducted into a province the most extensive, and by far the most populous, of the whole empire of nature. The residence of quadrupeds, as we have seen, is confined to the land ; that of fishes to the water ; while birds are enabled to rise from the surface of these elements into the aerial regions. Nature, however, has assigned a still more extensive range to those animals upon whose history we are now to enter. They are found to pervade every part of her dominions, in num-

bers that defy all computation: For in nothing does the immensity of her works more strikingly appear, than in the infinite number and variety of those her smaller productions.

Entymology, therefore, of all the sciences, presents the widest field for investigation. The number of experiments and observations necessary to furnish a complete history of so many small animals, is not only great; but the difficulty of making them is also immense. The number of ideas with which a skilful botanist must load his memory, before he can acquire an accurate knowledge of above two thousand plants, is no doubt great: his task, however, bears no proportion to that of the entymologist; for, amidst so many plants, there is perhaps hardly one that does not furnish nourishment and an habitation to several insects; while many, such as the oak, afford a retreat for some hundreds of different species*. These plants, however, are far from being the only abode of insects; vast numbers reside upon the larger animals, whom they continually suck; many live upon and devour others of their own order. Infinite numbers spend a part of their lives in the water; others remain there entirely: The earth swarms with multitudes; and the air teems with others, too small for the human eye to observe, and too numerous for the imagination to conceive!

While the numbers of this class of the animal kingdom thus exceed all our powers of conception, its varieties are also multiplied to a degree that renders a complete discrimination of them equally impossible. The different
species

* Mem. pour servir a l'Hist. des Insects, par Reaumur, Tome prim.
Page 2.

Species of insects are not only numerous, but each has its own distinct history, and exhibits manners, appetites, and modes of propagation peculiarly its own. In the larger ranks of existence, two animals that nearly resemble each other in form, will be found to have a similar history; but here, insects almost entirely alike will be found very dissimilar in their habits, and in the different changes which they undergo during their short lives *. To give a full enumeration of all the animals contained in this province of nature, would prove a task extremely arduous; one which no naturalist has ever pretended to accomplish. To furnish a distinct and complete history of each, is an undertaking for which the human powers seem altogether unequal; their imperfection, at least, forbids us to hope that it will ever be effected.

But although a complete history of the operations of nature in this large and populous part of her empire cannot be expected; yet, such a general picture may be given, as shall demonstrate the existence of that great vivifying principle by which she is animated, and by which she is enabled continually to pour forth into existence such immense numbers of organized beings. A history of such insects as most frequently occur, and whose manners are best known, will present to us a pleasing view of that protection which providence affords even to the smallest of its creatures;—of the means it employs for perpetuating them;—and of that great arrangement of nature, by which one set of living beings find subsistence, by devouring another, and by which life is continued through every part of the creation, without a pause.

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* Goldsmith's Natural History, Vol. VII. p. 239.

Natural history claims it as its prerogative to demonstrate the existence and the perfections of that Creative Power which produced, and which governs the universe: It is the history of the works of God, and naturally leads every intelligent mind to their Author; for there are no proofs of his existence more level to the apprehension of all, than those which it offers to the understanding. No rational man can ever blush for having placed among his occupations a study which has for its object the works of the Supreme Being which leads him to the contemplation of their author. All those naturalists who have described the different parts of the animal kingdom, have willingly confessed them to be productions of infinite power and wisdom; and seem to regret, that the experiments and observations relating to their history are not more numerous; because, in proportion as they are extended, the proofs of a Creative Power are multiplied.

The manner, however, in which entymology has too frequently been studied, and the extremes into which men, according to their different capacities and tastes, have fallen, have brought that obloquy and derision against the science, which a proper degree of discernment would have directed against the foibles of those who studied it. While the systems of some naturalists contain only a dry repetition of shades, colours, and shapes of different insects, without entering into the more interesting and animated description of their manners, those of others, as injudiciously, ascribe to them functions, and a degree of intelligence of which they are incapable. By the former, the imagination is fatigued and disgusted with a constant repetition of the same images: By the romantic air of the latter, the mind is led into distrust with regard to the truth of the whole narrative, and to doubt of those facts
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which are well established and certain. Hence the study of entymology has been deemed by many, an occupation the most useless and frivolous in which the human mind can be engaged: Hence too, from a fear of prostituting their talents, many have been deterred from contemplating the wonders displayed by nature, in a kingdom of animals the most numerous, diversified, and splendidly adorned, of any on the face of the globe; and thus have deprived themselves of views of the power and munificence of the Author of Nature, the most striking and interesting that can be presented to the mind of man.

To those who can derive no pleasure from the pursuits and studies of a liberal mind, and who feel no satisfaction in any employment that is not attended with immediate profit, the researches of the entymologist cannot seem altogether useless. Had the operations of the silk worm never been examined, how could men have availed themselves of the labour of an insect that administers so profusely to our luxuries and our wants? It was not to the unobserving that it first occurred, that the produce of that animal's labour might be converted into a considerable article of commerce, and might give rise to many arts, and afford subsistence to thousands of manufacturers. In the same manner, wax and honey enter into the articles of commerce, and add to our enjoyments. It cannot, therefore, be denied, that they were profitably employed, who first observed the industry of the bee; who brought that animal from its native woods, introduced it into our gardens, and, by domesticating it there, have rendered it subservient to our enjoyments.

The *Chinese*, whose progress in many of the arts is superior to that of any other nation, avail themselves of the labours of certain insects, in procuring a rich dye,
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and an elegant varnish, which is provided by a certain species of winged ant. The celebrated purple dye of the ancients was the produce of a small species of shell-fish; and we are told by *Pliny*, that the discovery of its virtue was occasioned by a dog, who, in eating the fish, had dyed his ears with that beautiful colour *. It seems probable that the ancients were capable of communicating to their stuffs many beautiful shades of scarlet with which we are unacquainted; and it is not unlikely that we have also some rich tints of that colour which they wanted. It is certain that our finest red colours are furnished by insects with which they were unacquainted. *Cochineal*, the extensive and profitable uses of which have been long known, is now universally allowed to be an insect, which is propagated with care, and in vast numbers, in the kingdom of *Mexico*. The *kermes*, or grain of scarlet, which was formerly imagined to be one of the galls or excrescences that are seen on shrubs, is now understood to be an insect, which attaches itself in that form to a species of the oak †.

The medical uses of certain insects are far from being inconsiderable; and to these purposes they have long been applied, perhaps more frequently, and with better effect, than at present ‡. The valuable purposes to which the

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* Reamure, Tome I. p. 5.

† The *quercus coccifera* of *Linnaeus*. The red dye collected from this tree is produced in Africa; it is not so bright, but more permanent than cochineal. The *coccus quercus* forms galls upon the common oak, which are brought from the Levant, and are universally used in dyeing over Europe. We have this plant in Britain, and also that of the *coccus polonicus*: The insect which inhabits these plants might in all probability thrive, if imported into this island.

‡ Hist. Medic. des Anim. par *Vanden Bosche*, Liv. iv.

cantharides has been made subservient, will alone vindicate the utility of those researches which have been made concerning this part of the animal kingdom. There are other uses to which insects have been applied, and that from the most remote antiquity, which appear of a still more singular nature. Before the time of *Theophrastus* and of *Pliny*, certain kinds of them were employed in ripening the figs throughout the islands of the *Archipelago* *; and it appears that the same practice still subsists among the present inhabitants of these islands †. There are two kinds of figs cultivated around the *Mediterranean*; the wild, and the domestic. The former produces fruit several times in the year; and in it are produced certain worms, which are afterwards transformed into small flies. It is by the assistance of these little animals that the domestic fig is brought to maturity, which would otherwise drop from the tree in an unripe state. During the months of June and July, the peasants of these delightful climes are busily employed collecting such of the wild figs as abound most with these insects, and in placing them near the cultivated fig, that they may co-operate with the climate in bringing it to maturity. Similar purposes might probably be served by a judicious application of insects to fruit in more northerly climates, were we acquainted with the proper species. Those prunes, pears, and apples which are first ripe, are commonly found penetrated by worms.

But there are other inducements to the study of insects, of a nature totally different from those already mentioned; inducements, founded not on any hope of advantage to be derived from these animals, but of alleviating

* Vide *Plinii Hist. Nat.*

† *Voyages de M. de Tournefort.*

leviating or preventing the numerous mischiefs they occasion. Infinite swarms of these animals annually desolate whole provinces; others attack our gardens and cultivated grounds, where they commit endless devastations upon the corn, vegetables, and fruit trees. Nor are their depredations confined to the fields; they enter the habitations of man, and by destroying the timber, gradually reduce them to ruins. They destroy his furniture and clothing; some of them spare not even his person, tormenting it long before the period which nature has destined it to become their legitimate prey. Here, then, is a wide field laid open for study; and the person who could inform mankind how to remove or alleviate these mischiefs, would deserve better of his species than if he had discovered the longitude.

Thus, by a closer examination of the destructive powers of insects, we shall have melancholy proofs of their importance in the system of nature, and be persuaded, that however despicable they may appear, there is no class of animals whose history more nearly concerns us, and which better deserves the attention of the naturalist.

There are four different species of the locust which are remarkably destructive. Almost every year, whole provinces, the most fertile in *Asia* and *Africa*, are laid waste by their depredation. In *Tunis* and *Algiers*, swarms of the *grillus migratorius* appear so numerous, that they darken the face of the sky, like a thick cloud. These pernicious animals are waisted there by the southerly winds in the month of April: In May they take their departure for the interior parts of the country, to propagate their young; these make their appearance in their *larva* state, during the month of June, when they commit vast depredations. The first columns, which pervade

the country like an army, destroy every green shrub and pile of grass; and their devastation has not ceased, when they are succeeded by other swarms, that press upon their rear, devouring the tender branches and stalks of plants, which their forerunners had left. This dreadful visitation, which the language of Scripture has justly described as a plague, does not terminate till the insects have passed into their winged state, when they fly off, leaving the whole surface of the earth naked and brown, as if scorched by fire.

Little inferior to the locust in its destructive powers is the *Phalæna Graminis* of *Linnaeus*, which destroys the meadows in *Sweden*: There the peasants are employed in cutting deep ditches in the surface to stop the progress of the larvæ as they pass along: If the swarm be small, this device has the desired effect; but the numbers of these animals are often so great, that they fill up the trenches, and pass along over the dead bodies that are buried in them. The formica sacchilifera is a native of the *West Indies*, where it pervades the plantations of the sugar-cane, entering the plants, and destroying them when they are tender: After long experience of its depredations, the inhabitants have never been able to invent a method of destroying this pernicious animal. In our own country, the turnip-fly, the butterfly, and the gooseberry worm, have long committed depredations in the fields and gardens, which no invention has hitherto been able to prevent: Against the last of these animals, indeed, the watering the bushes with an infusion of tobacco, has been found efficacious, by killing the greater number in their larva state.

Another object highly worthy the attention of the entomologist, is the means of preserving corn from the invasion of insects, after it is collected into granaries. Our subsistence in almost every stage of its progress, is constantly exposed to the intrusions of these enemies of human industry. Flour, biscuit, and almost every kind of provision, even after it is barrelled up for exportation, is liable to be devoured, or rendered useless, by the depredations of the most hideous animals. The patriotism of statesmen, and their zeal for the good of mankind, could not receive a nobler or more useful direction than in holding out rewards to such as might discover the most effectual means of preventing the ravages of those animals, who, by the most destructive activity, are continually converting large stores of provisions into so many masses of corruption.

May it not be hoped, that by a careful study of the nature of insects, some means may be discovered to prevent them from penetrating into the joists of buildings, and thereby reducing them into dust, and effecting the destruction of the most costly edifices. How often do we find wooden furniture destroyed by insects, which might have answered the purposes for which it was intended for ages, had it been preserved from the destructive attacks of these animals? How many accidents are probably occasioned at sea by those formidable worms, whose heads are armed with hard shells, and who are thereby enabled to gnaw through the thickest vessels, and make perforations under the water? The alarms they have frequently occasioned in *Holland*, by introducing themselves and multiplying among those wooden stakes which support their dikes, are universally known. The naturalist who should
discover

discover a mode of preventing such devastations, would certainly deserve well of his country and of mankind, by communicating information that tended so directly to the public good.

The tar extracted from coal by that ingenious nobleman the *Earl of Dundonald*, when better known, will probably be found an efficacious remedy against the corruptions of wood by insects in all cases where it can be applied. It not only penetrates so deeply into wood that it cannot be washed away; but is of so acrid a substance, as must inevitably destroy worms. The intolerable effluvia which it emits, will, however, prevent its application in the case of household furniture.

The pernicious genus of *phalæna*, which contains all the different species of moths, makes still nearer approaches to man in the hostilities which it commits. No person is ignorant of the destructive quality of these insects to woollen cloth, and all kinds of fur and wearing apparel. The astonishing instinct of these animals, in providing a proper receptacle for their eggs, and food for their young, have not withdrawn that indefatigable entymologist *Reaumur*, from devising efficacious methods of preventing their depredations upon woollen stuffs and furs*.

Of such vast extent are the mischiefs occasioned by the insect tribe upon the various objects of human industry, and the necessaries of life; all these, however, would in a manner disappear, were we to reflect upon their dangerous effects upon the human body, and the husbandman's attention would be withdrawn from the depredations committed on his fields, did he imagine that thou-

* Vide Mem. de l'Acad. 1728.

sands of the same noxious race were continually entering into his lungs by breathing. During the whole of the summer months, the atmosphere teems with myriads of small animals, and particularly in the months of July and August: It is then that the excessive numbers that are conveyed into the stomach and lungs, probably generate those epidemic disorders for which that season of the year is so remarkable. If we pass from those dangers which are less visible, to others more apparent, with which insects threaten the human race, we shall still find room to commiserate the inhabitants of many parts of the globe. What an uncomfortable life must the poor *Laplander* lead, since, at certain seasons of the year, the number of insects is so great, that a candle is no sooner lighted than the flame is extinguished by the multitudes that flock to it; where, after millions are destroyed, famished millions succeed, and renew the unceasing combat. Even in *Britain*, which is happily free from these unrelenting invaders, much inconvenience is often felt from the bug, the hornet, the wasp, and the bee*.

To counteract these inveterate enemies of man, and to relieve him from the mischiefs they occasion, ought always to be one aim of the entymologist: and no person will deny, that whoever, by the study of insects, has found the means of availing himself of the labours of such as are useful, or preventing the noxious from doing harm, hath rendered an essential service to mankind.

After all, however, it will readily be allowed, that in pursuing the history of insects, the number of useful observations

* The first of these animals has been found to be effectually destroyed by the smoke of peat.

observations with which it presents the reader, bear but a small proportion to those whose object is merely to gratify curiosity. But in what science is there nothing to be found but what is immediately useful? and are not objects of curiosity often nearly allied to those of utility? Is it not while we amuse ourselves with the former, that we are most frequently led to the discovery of the latter? To these circumstances, we may add another for the encouragement of those who undertake to write upon this subject; that works the most useful are not always the most favourably received: The number of those who read for amusement, is at least equal to those who read for instruction. A taste for the marvellous, in a greater or less degree, is universal among men: It is this which leads them to prefer romances, novels, *Persian* and *Arabian* tales, to the incidents of real history. The generation, the metamorphoses of insects, their means of rearing their young, and of procuring food, present to the reader wonders, perhaps not inferior to those that are fabricated by the most licentious imagination; with this difference, that the latter are true. The entymologist therefore, has himself rather than his subject to blame, if his works are not read by the public with avidity.

SECT. II.—*The Literary History of Entymology.*

THE class of insects, although by far the most numerous in the animal kingdom, the most remarkable for its effects on the objects of human industry, and perhaps the most important in the economy of nature, was long before it attracted any considerable degree of attention from men of learning. Hardly any attention was bestowed on entymology by any of the writers of antiquity. *Aristotle*, that father of naturalists, has allotted but a small portion of his works to the history of insects; nor does it appear that he has been always sufficiently attentive to the authorities upon which he inserts the different facts he relates, or to the order in which they are arranged. It is known, that *Alexander* his pupil furnished him with considerable sums to be employed in the various researches necessary for the compilation of his history of animals; and it is not improbable, that many persons were engaged in different parts to procure him the different species, and to furnish him with such observations on their history as fell not within the reach of his own knowledge. From several of the facts which he has related, we are led to suspect, that these men were not altogether qualified for the task in which they were employed. The arrangement followed by the *Grecian* naturalist seems as defective as the authorities upon which his

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his observations are founded. It consists of a long and tedious enumeration of animals, whose appearance and history correspond in certain particulars; followed by another of those which differ from the former. Enumerations of this kind are seldom complete, and long before they can become so, must prove a burden too great for the memory to retain*. The histories of *Pliny* and *Ælian* are formed upon the same plan, and are liable to similar defects: They consist of a number of observations ill arranged, and insufficiently authenticated.

During that long succession of ages, which was only distinguished by ignorance and barbarism, entymology shared the same fate with every other science: It was condemned to oblivion. After a taste for literature had begun to revive, the history of insects again attracted the notice of the curious; unhappily, however, for the growth of science, men were then devoted to the study of the ancients with a blind admiration: It was from their writings that they imagined the moderns were to derive a complete knowledge of all the secrets of nature; and *Aristotle* was principally consulted for the history of animals. Had *Aldrovandus*, *Gesner*, and *Mouffet*, bestowed the same attention in studying the works of nature that they employed upon the writings of that naturalist, they would have made a much greater progress in real knowledge: But they unfortunately observed nature only to observe there what they had read from *Aristotle*. This excessive predilection for antiquity ought not indeed so much to be imputed to these authors as to the age in which they lived; a period when every thing was
deemed

* Vide Hist. animal. passim.

deemed contemptible, that was not found in the writings of the ancients.

The attempts of these early writers gave birth to the researches of others, who were gradually more bold and successful, in proportion as their reverence for antiquity was diminished. In 1668, about twelve years after *Mouffet* published his *Theatrum Insectorum*, the experiments and observations of the celebrated *Rbedi* made their appearance in *Italy*. His investigations were principally directed to the manner of the generation of insects, with a view to overthrow that absurd and erroneous doctrine established by the ancients, of their arising fortuitously from different bodies in a state of putrefaction. Nothing can more fully demonstrate the strength of prejudice than those elaborate treatises which *Malphigi*, *Swammerdam*, and *Rbedi* were obliged to compose, in order to combat the notion of the spontaneous generation of these animals; an opinion which at present seems as ridiculous and unphilosophical as it is untrue. Notwithstanding all their efforts to prove, that the smaller animals are produced in the same manner with the larger, and that the organization of the body of a mite requires the same apparatus of limbs, and the same delicate structure as that of an elephant, attempts were still made to revive the ancient error by *Kirker*, *Bonarie*, and others *. And what is most mortifying to human reason, the same *Rbedi*, the declared enemy of prejudices; and the man of all others who knows best how to combat them, has, upon this very subject, fallen into a similar error. In order to produce those insects which are
found

* Vide *Motivi di dubitar intorno la generatione de viventi, secondo la opinione de moderni.*

found upon the small excrescences of plants and trees, he found himself obliged to confer a vivifying power, a kind of soul upon those vegetables where they were found, and has laid aside the ordinary mode of generation, which in other instances he had laboured to establish.

Swammerdam was the contemporary of *Rbedi*; and, like him, he possessed the courage to examine nature, and to think for himself. This naturalist made many anatomical observations upon insects, which after his death were published at *Leyden* *, and laid the foundation of future improvements in entymology. About the same period, *Madame Marianne*, a *Dutch* lady, contributed largely to bring the history of insects into request, by the beauty of her paintings and drawings. After having executed elegant drawings of several of the insects of *Europe*, from a singular avidity for these studies, she was prompted to cross the *Atlantic*, and give paintings of those in *America*. Having resided for several years in *Surinam* in *South America*, she returned to *Europe* with exquisite drawings of many of the splendid insects of that continent, which were afterwards engraved and published in *Holland*, about the end of last century †.

Goedart is another of the first authors who adorned the history of insects with the labours of the pencil. He paid great attention to the metamorphoses of the animals, and has painted many of them in the several forms which they assume, from their appearance till their death. His work was originally published in *German*, very badly ar-

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* In the year 1737, under the title of *Biblia Naturæ*.

† Her original drawings were purchased by Sir Hans Sloane, and are now in the British Museum.

ranged; a new edition in *Latin* was afterwards given by Dr. *Lifter*, in which many errors were corrected, and a new arrangement made out by that able naturalist, who has himself written a valuable treatise upon the intricate genus of spiders.

Some of these authors, by the extent of their labours, and others by the boldness of their genius, had convinced mankind that the ancients were far from attaining that perfect knowledge of nature which they had hitherto imagined. They were now so far emboldened by the progress they had already made, that they trusted to their own judgment and observation in examining the works of nature; and many productions far more judicious, accurate, and philosophical, were offered to the public, than had ever hitherto appeared. Among the first of these may be ranked that of our celebrated countryman Mr. *Ray*, who had, for the greater part of his life, assiduously examined the economy of insects. His *Methodus Insectorum* was not published till after his death in 1710, and may be regarded as the most accurate and concise performance on the subject of entymology. In the meanwhile, there appeared a numerous list of authors who treated this class of the animal kingdom; *Albin* described the insects of *England*, while *Sir Hans Sloan*, *Petivert*, *Catesby*, and *Frisch*, have detailed the history of vast numbers of exotic animals of this tribe.

In this state of the science, about the year 1754, appeared *M. de Reaumur*, by far the most laborious and indefatigable entymologist in *Europe*. Almost in every part of *France* this naturalist had correspondents stationed to transmit him by post descriptions and specimens of every curious and rare insect that might occur: And in

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order to examine their instincts, their metamorphoses, and mode of generation, he inclosed vast numbers of them in a large aviary, constructed with a close net, and secured below with a pavement overlaid with green turf, and planted with shrubs and different kinds of plants. It was there that this unwearied observer of nature examined the manners and economy of those insects, which he has described in a work the most voluminous that has hitherto appeared on entymology. As a writer, he is extremely diffuse, but always entertaining and instructive. The principal defect in his works is the want of a systematic arrangement, and the synonyma of other authors; a precaution that was alone able to have prevented confusion in so large a performance, and amid the vast number of insects which he has described. These defects, however, were soon remedied by that excellent arrangement which the immortal author of the *Systema Naturæ* has introduced into entymology, as well as every other department of natural history. No philosopher hath ever yet appeared who possesses the same powers of classifying the different productions of the various kingdoms of nature; and his system will probably long continue to be a standard to all those who shall afterwards attempt to make improvements, or to enlarge the boundaries of natural history.

Since 1715, when the system of nature was first published by *Sir Charles Linnaeus*, various improvements have been made on it by that author, who has enjoyed the rare felicity, not only of seeing his works gain universal approbation, but of many opportunities of bringing them nearer to perfection. In the mean time *Geoffey*, *Scopoli*, *Wotton*, *Harvey*, *Valisnieri*, and many others of in-

ferior note, have turned their attention to this interesting part of natural history; and while they have endeavoured to improve upon the arrangement of the *Swedish* naturalist without success, have nevertheless added greatly to the number of insects. Among this number *De Geer* a *Swedish* nobleman, counsellor to the king, may be ranked in the first station: He has published a large treatise upon this subject, in which he has not only described a great number of insects with accuracy, but has indulged in philosophical remarks upon their history, which possess very considerable merit.

Besides these, a number of entymologists have appeared, who have given most elegant engravings of insects; among which are, *Roefel*, *Lewenboeck*, *Baker*, *Barbut*, *Harris*, and *Drury*. Some of these have improved this science by microscopical observation: the last has given excellent drawings of the exotic insects, while *Harris* has applied himself successfully in delineating those of *England*.

After reviewing the numerous list of authors who have laboured in the same field, we should widely err, were we to conclude that the science of entymology had reached perfection, or that the whole of this class of beings had been fully made known. The far greater part of insects, as we have already hinted, from their extreme minuteness, elude the observation of the naked eye; many, it may be presumed, are not perceptible even by the assistance of the best microscope; and of these small animals, whose bodies are scarcely discernible, how little can we know of their organization, their food, their manners, and their history? In the latest edition of the system of nature, near three thousand insects are enumerated by

Linnaeus:

Linnaeus : There is, however, good reason to apprehend, that this enumeration does not contain above one half even of the larger insects that are distinctly observable by the eye. Whether in a hot or cold climate, it is probable that the number of insects in every country is greater than that of plants. In *Sweden*, there have been enumerated, and pretty accurately described, about one thousand seven hundred insects, while the number of plants, though no where more accurately examined than in that kingdom, do not exceed thirteen hundred. In the neighbourhood of *Paris*, there have been discovered by *Geoffrey* and *Reaumur*, upwards of one thousand four hundred insects, while the plants of the same district, which have been still more accurately examined than the insects, do not nearly amount to that number.

The *British* insects have never yet been either fully enumerated, or accurately described. *Dr. Berkenboot*, in his outlines of the natural history of this island, has enumerated five hundred and seventy-two different species : In all probability, a more complete investigation would discover three, or perhaps four times that number of *British* insects. The nearer any country approaches to the equator, the more numerous will be the insects found in it : Even in these northerly climes, however, there is still much room left for entymological investigation. If, in travelling over this ground, we cannot flatter the reader with much new matter, we can at least assure him, that he will not be led astray by theory, or deceived by unauthenticated narrations.

SECT. III.—*A comparative view of the Senses and Endowments of Insects, with those of other Animals.*

THE more closely we examine this class of the animal kingdom, the greater number of surprising facts and wonderful instincts shall we find, to indemnify us for those large portions of the marvellous, of which we shall often be obliged to divest their history. Many entomologists, it must be allowed, particularly those who wrote in the earlier stages of this science, before philosophy had thrown much light upon the operations of nature, from a desire of filling the reader with the same admiration which they themselves felt, have much oftener had recourse to the marvellous, than can either be justified by facts or observation. Those eulogies which we find so frequently bestowed, without measure, upon the intelligence of certain insects, afford pregnant evidence of this indiscretion. There is hardly any kind of knowledge, endowment, or even moral virtue, of which some or other of them has not been said to be possessed. They have been made to act and think like men; and sometimes have been celebrated for accomplishments of which few of these lords of the creation can boast; and all this on the most puerile and false foundations. For example, there is a species of the mantis, with long limbs, and of an uncommon appearance; and because this animal is frequently seen in an erect posture, having the two fore legs

legs crossed, it has been said to be employed in devotion ; a circumstance from which it has in some parts obtained its name *.

The same insect is said to have such a regard for children, that, should one lose its way, it humanely points to the proper way with its leg, and seldom is known to give a wrong direction. Of this kind, too, is the respect for their dead, which has been ascribed to the ants, and the decency with which they bestow the honours of interment upon their deceased friends. These reports rest upon no better foundation, than that these animals, and some species of bees, are seen carrying from the hive such as have perished or been killed. How many wonders of a similar kind have been told of the common bee ; wonders which render the greater part of the early treatises upon them hardly more instructive than a romance. Their associations have been deemed a perfect model of a monarchical government, conducted by one sovereign, whose commands are implicitly obeyed, and regulate all the different operations in which they are so busily employed. From farther investigation, however, this king of the bees has a queen, and so prodigiously prolific, that from three or four, which are to be found in every hive, the whole progeny, which consists of many thousands, is derived.

The different operations which insects perform, no doubt oblige the naturalist to ascribe to them a certain degree of intelligence ; some degree of it we have seen possessed by the other animals : From analogy, therefore, we may reasonably suppose them not altogether destitute of sagacity. The different processes through which they

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* Vide Muoffet, p. 118. In Provence, it is called the God-prayer.

go, are so uniform, and that succession of actions which we see them perform, are so little varied, that nature seems to have destined them to act a subordinate part in the great republic of animals. If their history sometimes exhibits them varying their procedure, and accommodating themselves to circumstances, the sphere of their address seems to be confined within narrow limits; and it is seldom that they attract our admiration by any extraordinary efforts of sagacity. The bee and the ant present striking instances of assiduity in labour; they have, however, but one single method of operating, and, withdrawn from that, can turn to no other. A bee taken out of the hive is totally helpless and inactive; far from displaying the sagacity of the dog, it seems incapable of giving the smallest variation to its instincts. In the pursuits of the latter animal, there appears something like choice; in the labours of the former, the whole appears like necessity or compulsion*.

The conformation of the whole insect tribe seems also to argue its inferiority to many other parts of animated nature. In the external and internal structure of the body of one of these small animals, where every member appears completely formed, and co-operates with the rest in carrying on the vital functions, there is no doubt displayed a very wonderful organization. Insects, however, of all animals, are perhaps the most imperfectly formed; nor is this assertion founded on any investigation made upon these minute creatures by means of the eye, or the knife of the anatomist; it is obviously deducible from their capacity of subsisting after being deprived of many of those members and organs, which, in the higher ranks
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* Goldsmith's Nat. History, Vol. VII. p. 236.

of nature, are absolutely necessary to life. Many of them, like the nobler animals, are furnished with lungs, and an heart ; yet the caterpillar lives, though its heart and lungs, as is often the case, are entirely eaten away. In some, the stomach perishes altogether, and is again renewed ; others, after being cut into several pieces, not only continue in life, but are formed into as many new distinct animals as there were segments of the old ! As in mechanics, the most complicated machines are required to perform the nicest operations, so, in anatomy, the noblest animals are most variously and wonderfully made *. Of all living beings, man offers the most wonderful variety in his internal conformation ; quadrupeds come next ; and after them the other animals follow, in proportion to their powers and excellencies ; while insects seem to fill up the last and lowest rank of animated nature ; some of them being so imperfectly organized, that they have long remained in the systems of naturalists confounded with the vegetable tribes.

The amazing number of insects is another argument of their imperfection. It is a rule which obtains among the offspring of nature, that the nobler animals are slowly produced, and that, in forming these, she acts with a dignified economy ; while, in her meaner births, she is often lavish to profusion ; and thousands of the more ignoble kinds are produced merely to supply the necessities of the more favoured and delicately organized parts of her creatures. Of all the other productions of nature, we have seen that insects are the most numerous ; that, however minute when taken individually, when taken together they are probably more bulky than all the rest

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* Idem, ubi supra.

of her animated offspring. The plants and vegetables which cover the surface of the earth, and which at first sight appear so far to outnumber the other productions of nature, upon a closer investigation, are found far inferior in number and variety to the insects which swarm in the wider range of the air, the earth, and the water.

From these considerations, we are induced to believe, that the degree of intelligence allotted to this class of the animal kingdom is but very small; and our experience, as far as it goes, coincides with this opinion. While other animals are capable of some degree of education, these have one invariable mode of operating, which no art can either alter or improve. The dog is taught to carry; the bird to whistle a tune; but those insects which may be considered as completely domesticated, can by no invention be turned from their instinct. The silk worm completes its labours, and the spider constructs its web, invariably in the same manner: An existence which continues but a single season, seems too short for the purposes of instruction, or of learning. Hence the insects are not only of a rank inferior to the other animals, but many of them seem more nearly allied to the vegetables than to the classes above them. Many are attached to one vegetable, some to a single leaf, where the period of their lives is completed in a few weeks, or perhaps a few days, and where the pleasures they enjoyed, or the purposes for which they were produced, are in a great measure beyond the reach of our faculties to explore.

The external senses of insects, as far as we are enabled to judge of them, correspond with the low measure of sagacity which the Author of nature has assigned them: Of some of them they seem altogether destitute, while others are enjoyed but in an imperfect manner. It has

long been a received opinion, that hearing is denied to insects; or at least, that the existence of this sense is very equivocal. Many of them, however, are endowed with the power of uttering sounds; as the bee, the fly, the gnat, and the beetle. The *sphinx atropos* squeaks when hurt, nearly as loud as a mouse; it has even the power of uttering a plaintive note, in certain circumstances, which excites commiseration. In general, the power of uttering sounds agreeable to the feelings and necessities of animals, is conferred on them for the purpose of communicating these feelings to the rest of their kind. We have already seen, that such of the finny tribes as were vocal, were also endowed with organs for the reception of sounds; the same, probably, is the case with the insect tribe. For what purpose is the individual possessed of the power of expressing its pleasures or its pain, if all knowledge of sound is denied to its tribe? Were the sense of hearing withheld from the animals of the same class, it must crave assistance in vain; for it must speak a language destined to be unintelligible to every being in nature*.

Experience daily convinces us of the truth of the foregoing positions. If a bee or wasp be attacked near the hive, the consequence of this assault commonly is, that the animal expresses its pain or indignation in a tone different from its ordinary noise; the complaint is immediately understood by the hive within, when the inhabitants hurry out to revenge the insult, in such numbers that the offending party seldom comes off with impunity. The same evidence of hearing is continually afforded by the spider: Often his webs are of such an enormous

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length,

* Vide Barbut's *Genera Insectorum*, p. 4.

length, that he cannot see from the one end of them to the other; often too, in watching for his prey, he conceals himself in some adjoining crevice, where he cannot see those animals that are ensnared in his toils. The fly, however, no sooner finds itself entangled, than it makes a buzzing noise, in order to escape; this noise is instantly heard and understood by the spider, who sallies forth from his concealment, and riots in the spoil, with all the eagerness and ferocity which distinguishes the most rapacious animals*.

If the sense of hearing has with difficulty been allowed to insects, naturalists have had still more in ascertaining the place or organ where that sense is situated. The most accurate observers of nature have supposed it to be placed in the *antennæ*: These, from their situation in the head, from their inward structure, and their capacity of motion, have been supposed most favourable for the seat of such organs. Besides, it is difficult to assign any other use for these instruments, which are common to almost the whole of this class of beings. From their extreme sensibility, they seem neither fitted for the purposes of attack nor defence: While, then, it is certain that providence hath made nothing in vain, but hath framed every limb of the smallest animal for use, as well as ornament, it seems to follow, that the *antennæ* of insects are the appointed organs of hearing, since there is apparently no other purpose in the economy of these animals which they seem fitted to serve.

The *antennæ* of all insects are composed of joints, varying in form, size, and number. Among those which are confined to live mostly under water, as the *gyrinus*, they

* *Genera Insectorum, ubi supra.*

they are in general short; while such as roam at large through the air have them long and slender, as the phalænæ ichneumons, and others. They are all hollow within, and rendered flexible by the joints, which are very visible in those of the crab; which are the best examples, because the largest belonging to this class of beings. This hollowness, it is supposed, is intended to receive the sound communicated to the extremities of the antennæ, by the repercussion of the air; and to convey it, by means of the joints, from one piece to another, till it arrives at the brain, in that lessened degree of tone which is suited to the nature of the particular animal*. Such is the apparatus destined for the hearing of insects; a sense which they probably enjoy in various degrees of perfection; but in none of them does it seem so acute as in the higher ranks of animated beings.

But, besides the sense of hearing, it seems highly probable that insects possess also that of smell. As many of them live on bodies in a state of putrefaction, around which, when exposed, they are seen immediately to collect themselves, the conclusion seems obvious, that they are possessed of organs fitted to direct them to their food. Those which feed on herbs, flowers, or fruits, seem in the same manner to require senses adequate to their pursuits. It has therefore been supposed, and not without an appearance of probability, that the *palpi*, or feelers, are the organs of smell in the insect tribe. These instruments are four, sometimes six in number; two of which are evidently destined to the purpose of handling their food, and conveying it to the mouth. The others, which are in continual motion, and constantly applied to those objects

* Genera Insectorum, ubi supra.

objects on which they alight, seem employed, like the snout of a hog, in searching for food, and examining the quality of the different kinds of sustenance by which they are supported. The beetles, and other tribes whose *pulpi* are large, are proper subjects for examining the organs of smell in this class of beings; and an accurate investigation of their manners would probably justify the foregoing conjectures with regard to the uses of the feelers, and determine how far they possess this sense.

The organs of vision among most kinds of insects are large; a circumstance which has put their sense of seeing beyond a doubt. The eyes are commonly two in number, each frequently consisting of a congeries or assemblage of *lentes*, covered with a crustaceous transparent substance, to protect them from injury. The organs which have been allotted to hearing and smell, are also protected from dust, and the smaller particles of those substances to which they are applied: Their extremities are not patulous, but ciliated, like those of the mole, to prevent them from being clogged or injured by the intrusion of surrounding objects. Hence it appears, that though insects are destined to fill a subordinate station in the animal kingdom, yet nature has by no means neglected them, but furnished them with organs wonderfully adapted to their humble pursuits, and to that transient existence which she has assigned them.

SECT. IV.—*Of the External Parts and Classifical Characters of insects.*

INSECTS have always been considered as a distinct class of the animal kingdom, though naturalists have not agreed in ascertaining its limits. The shades of nature are indeed intimately blended together; and those links by which she connects different portions of her animated offspring, are often small and imperceptible. The insect tribe comprehends those small animals which are destitute of red blood, bones, and cartilages; which are furnished with a mouth, or else a trunk, opening lengthwise; and which breathe by means of stigmata, or apertures upon the external parts of the body. They have obtained the name of insects from the frequent incisions by which their bodies are apparently divided into several parts or segments.

The body of these animals is divided by naturalists into a head, thorax, abdomen, and limbs. The head is, for the most part, distinct from the thorax, being attached to it only by a slender tendon, and is furnished with eyes, palpi, and antennæ, which we have already seen are the organs of the different senses. This whole tribe of animals is supposed by *Linnaeus* to be destitute of brains*.

The antennæ are organs peculiar to insects; and according to their various forms and proportions, afford systematic

* Vide *Systema Natura*, Tom. I. Part I. p. 535.

systematic writers the most proper characters for the arrangement of those animals. According to their form, they are either setaceous, filiform, moniliform, clavated, capitated, fissile, pectinated, or bearded; and in their proportions, they are either longer than the body, or shorter, or of equal length with that part.

The *feelers* have already been noticed, as constituting the organs both of touch and of smell; and have two, three, and sometimes four joints. Some insects are said to have no mouth; in general, however, that organ is situated under the head, and to it the feelers are attached: In some species, the mouth is placed under the breast; in others, the rostrum is of considerable length, having an upper lip, transverse jaws, teeth, and a tongue, not unfrequently rolled up in a spire. The stemmata, or small eyes, are three brilliant convex spots, situated upon the crown of the head.

The thorax is placed between the head and the abdomen, and is that part to which the *fulera* or limbs are attached: immediately behind it is placed the abdomen, containing the stomach and viscera. It is divided into five segments, each pierced on the sides with small foramina for the purpose of breathing. It was long imagined, that all the animals that are destitute of red blood lived without respiration: It has, however, been found by experiment, that this is not the case; and that, among the insect tribes, breathing is carried on, though in a different manner, from what takes place among the larger animals. Insects are all furnished with minute organs, which, in the language of naturalists, are termed *stigmata*; these are a number of small tubercles, ranged along each side of the body, each having an aperture in the top, called the spiracle, by which the animal breathes.

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These stigmata are commonly situated on the sides both of the thorax and abdomen; and their number is various, being from eight to twelve. When the uses of these organs at first began to attract the attention of naturalists, it was imagined, that by means of them the insect only inspired, and that the air was ejected by the pores in the common manner, by perspiration.

This opinion was adopted by *M. de Reaumur* *; but subsequent experiments have proved, that the air is both introduced into the lungs, and emitted from them by the spiracles: If the stigmata are covered with oil, respiration totally ceases, and the animal dies; if they are covered only on one side, the vital functions on that part are impeded, and the side becomes paralytic †. Nor is it in their winged and active state alone, that insects breathe. The crustaceous shell, by which the chrysalis is covered, is also provided with lateral stigmata, by which respiration is carried on during the period of their pupa state. In the breathing of insects, there is still another peculiarity; they thrive in air tainted by putrifying substances, and are capable of subsisting in phlogisticated air, the inspiration of which is so fatal to other animals.

From the limbs of insects are obtained the most permanent and striking generic characters; these are most commonly taken from the tail, the legs, or the wings, in such subjects as are furnished with them. The tail terminates the abdomen; and sometimes has two horns, and sometimes none: It is either simple, or armed with a forceps, a bristle, a claw, or a sting ‡.

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* Vide Memoir pour servir a l'hist. des insectes.

† Bonnet.

‡ Barbut's genera insectorum.

The feet of these animals are generally fix; the crabs and spiders have eight, and the scolopendra has a much greater number. They are divided into the thighs, which are attached immediately to the body; the tibia or shanks immediately below the second joint; and the tarfi, which are composed of various articulations, and are terminated by nails: The hind feet receive different appellations, according as they are formed, for executing the various movements of walking, running, leaping, or swimming*.

The wings are in some subjects two, and in others four in number; and are so various in their colour, shape, and consistency, that they afford many characters for the distribution of these animals. The elytra or wing-cases are two, formed of a crustaceous substance, and for the most part moveable: They serve as a cover to the under wings, and furnish distinguishing marks to the naturalist. Under the wings of dipterous insects are placed the halters or poisers, which are composed of a small stalk, terminating in a round knob or head; and are supposed to serve the purpose of balancing the animal, as is expressed by their *French* name †.

After this short account of the external parts of insects, and explanation of the technical language by which they are expressed, the reader will be able to see the propriety of the *Linnean* division of this class of animals into seven orders; an arrangement which constitutes the basis of a system of entymology the most simple and judicious that has ever yet been devised.

The first order of insects is called the coleopterous: It consists of all those animals that have membranaceous wings,

* Hence they are called, cursorii, saltatorii, and natatorii, &c.

† Les balanciers.

wings, covered with crustaceous elytra, and is subdivided into thirty different genera, according to the shape of the antennæ.

The second order is called the hemipterous : because the wings are half covered with crustaceous elytra, and are less hard and robust than those of the coleopterous insects, but more strong than those of the membranaceous winged insects that compose the subsequent orders. The upper wings are semi-coriaceous : They do not meet together in a longitudinal future, as in the first order ; but have part of their interior margin crossed or lapped, the one over the other along the upper part of the abdomen. The mouth and proboscis of the insects of this order, are bent inwards towards the breast.

The third order comprehends the various tribes of moths and butterflies, whose wings are covered with imbricated scales, and which on that account are called lepidopterous insects. They have four membranaceous wings ; their bodies are rough, and the mouth furnished with a spiral tongue, which they can roll up, or unfold at pleasure.

The neuropterous insects constitute the fourth order, which comprehends all those genera which have four naked and membranaceous wings, reticulated with veins. The tail of these animals is unarmed, having no sting, but is provided with appendices like pincers, by which the sexes are distinguished.

The insects of the fifth order have the tail armed with a sting, excepting the males, which have not that offensive instrument. They have four membranaceous wings, and are called the hymenopterous insects.

The sixth order contains the depterous insects, or such as have only two wings : They are farther distinguished

by a poiser situated under each wing, the base of which is covered by a small scale, and the extremity terminates in a knob.

The last order comprehends in it all the apterous insects, or such as are entirely destitute of wings in either sex.

In giving the history of a class of animals so extremely numerous as that of insects, it becomes absolutely necessary to group them in certain tribes, whose manners or external characters correspond: Nothing but this expedient can prevent endless confusion among such multifarious forms, or afford any prospect of finishing a task, that, at first view, seems involved in such inextricable difficulty. All naturalists who have treated of this part of the animal kingdom, have accordingly endeavoured to arrange them into orders and genera. *Swammerdam* and *Ray* seem to have founded their systems on the different changes which these animals undergo, and have formed them into four great divisions, agreeable to the different forms under which they appear: *Valisnieri* has also distributed them into four orders, according to their habitation; arranging together in one group, such as inhabit plants; placing in another, those that live in the water; and in a third, such as conceal themselves under the earth or sand; reserving for his last division, those that inhabit the bodies of other animals*. Both those systems are defective, in having too few divisions of a class of animals so extremely numerous; the last, however, is liable to an imperfection of another kind; because many insects change their habitation, at the moment of their metamorphosis. Some are aquatic, which, after

* Vide Nouvelle idée d'une division generale des Insectes.

ter their transformation, are seen inhabiting the trees and plants; many of the subterraneous insects in like manner rise into the air, so soon as they arrive at their winged state. Several other attempts have been made towards the arrangement of insects, none of which seem to have been so successful as that of the *Swedish* naturalist above described: By his system, therefore, we shall be chiefly guided in the following sketch of the history of these animals.

SECT. V.—*Of the Generation and Metamorphosis of Insects.*

WE have already noticed the erroneous opinion which the ancients entertained concerning the generation of insects, and mentioned the efforts made by *Rbedi* and others, in order to combat it: After all their researches, however, this part of our subject is far from being free of difficulty. Insects are remarkable for a greater variety of sexes than any other class of animals. In general, each individual is either male or female; but there is one order (that of the hymenoptera, which comprehends all the numerous tribes of bees, wasps, hornets, and ants), among which there is found a numerous race of animals that are neuters. These take no part in propagating the different species to which they belong, but seem devoted to the service of the more perfect animals. This fact is
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fully ascertained by the history of the common domestic bee: all those which are employed in collecting the honey, and constructing the cells, and which constitute by far the greater part of the hive, are of the class of neuters, to whom nature has denied the power of propagating their kind. It is only upon the drones, and one or two females in each hive, that she has conferred the sexual distinction, and the powers of generation.

Hitherto we have uniformly beheld animals either male or female; and the neuters of the order of hymenoptera which form the first exception to the general law of nature, appear not only an anomalous but a defective race. The history of insects exhibits another instance of animals deviating from this rule, from a different cause. All the animals belonging to that genus, termed the *aphus pucceron*, appear to be hermaphrodites of the most perfect kind: A single animal of this tribe, though kept in the most careful manner from every other, will propagate its kind by itself; and if the offspring thus produced be preserved, it will also breed. An ingenious naturalist has well ascertained this fact by experiments, which he has repeated to the ninth generation*.

This mode of generation, so different from that effected by the joint co-operation of the sexes, naturalists have ascribed to a different power, something resembling that possessed by the vegetable tribes: We have already, however, seen instances of animals among whom fecundation by the male, impregnated the females for several generations. If that fact be well ascertained, it will explain the peculiarity of that tribe, without investing it with powers so different from all those possessed by the rest of the animal kingdom.

Insects

* M. Bonnet.

Insects are in general oviparous, producing eggs which are gradually quickened into life, by the joint influence of the heat of the sun, and of those warm substances which constitute their nidus. *Bonnet* mentions some instances in the order of diptera, in which the parent insect produces living young. The genus *aphlus* exhibits a singular phenomenon. This animal, during summer, is viviparous, but towards winter becomes oviparous; the state of its progeny being determined by the nature of the season.

The nidus in which the eggs of insects are deposited, is generally chosen with admirable skill; being adapted equally to the security, warmth, and subsistence of the future larvæ that are to be reared in it. Some construct their nests in the earth with great labour: others deposit their eggs upon those plants, the leaves of which are to supply food for the nascent brood: while several of the muscæ eject their eggs in the body of the chrysalis of other insects; upon the juices of which the young are nourished at the expence of the defenceless animal which they devour. Instinct is an unerring guide in directing each of these animals to a nidus fitted for the preservation of the *ova*. In one instance, the common blue fly is said to be deceived; and that is, when it deposits its eggs upon the flower of a certain plant of a putrid smell, mistaking it for flesh in a state of putrefaction. There the young are no sooner quickened into life than they die for want of proper food *.

The

* The skin, the nostrils, the anus, and viscera of quadrupeds, sometimes furnish a receptacle for insects; and there nature directs the parent animal to deposit its eggs.

The different changes of form which many insects undergo, from their first appearance as eggs, till they arrive at their perfect and winged state, constitute an important article in their history: These have been termed their metamorphoses, or transformations; and, from the very language employed to express them, the false notions which were long entertained, even by naturalists; are still discernable.

A fly, a spider, or an ant, insects of the most different kinds in outward appearance, do not differ more widely than the same insect does from itself, under the different forms of a worm, a chrysalis, and a butterfly. What is at present a worm, however, soon becomes a chrysalis, which is again as suddenly to be changed into a winged animal. Changes apparently so instantaneously produced, have been compared to the metamorphoses so renowned in ancient fable, and probably at first suggested the idea of those transformations which fable has rendered so celebrated. When an insect in so short a space, appeared under a form so different from that which it lately exhibited, men imagined that the change was real: They trusted to appearances, without giving themselves the trouble of reflecting on the improbability of the fact. They who imagined that a piece of rotten wood or putrid flesh could become the eyes, limbs, and body of an insect of such delicate organization, and consisting of muscles, nerves, veins, and arteries, could have but little difficulty in admitting, that the flesh of a chrysalis might be transformed into the wings of a butterfly, or that the sixteen limbs of a silk worm might furnish six for a moth.

After true philosophy appeared, one of the first lessons she gave her votaries, was to beware of trusting too implicitly to appearances, and of admitting ideas that were
neither

neither clear nor intelligible : It was then that men began to recognise, that sudden metamorphoses were none of the expedients which nature employs for the production of her offspring. This point was successfully laboured by *Malpighi* and *Swammerdam*, who carefully examined those insects that appear under different forms. By dissecting them, a short time before the period of their transformation, they observed that their first form was owing to a covering under which their different members were to acquire their proper size and firmness : That all the parts of a butterfly, for example, were perfectly distinct under the skin of the worm which covered them ; and that under the crustaceous shell of the chrysalis, they were still acquiring greater degrees of strength ; and were fast approaching to that state in which they were destined to appear, when the animal should arrive at perfection, and be able to propagate its kind.

From the experiments of these naturalists it appeared, that all the parts of the most perfect winged insect were distinctly formed, and gradually acquired size and strength, under the different forms of a worm and a chrysalis, and that its progress and growth proceeded rather by developments, than by a real change : All the marvellous ideas conveyed by the terms transformation and metamorphoses thus vanished ; and a beautiful analogy was established between the growth of all organised beings, whether in the animal or vegetable kingdoms.

A silk worm, or the worm of a butterfly, which is about to enter into its chrysalis state, is observed for some time before to grow languid, and to cease from gnawing those plants of which it was formerly so voracious : After having retired into a place fit for its purpose, and un-

dergoing a few convulsive struggles, the skin which covered it, and gave it the form of a worm, bursts, and the animal within makes its appearance; at first it is soft and tender, and covered with a viscous fluid which ascends from the body. but which afterwards hardens into that crustaceous shell in which all the members are again locked up, till they acquire greater firmness and stability. This viscous fluid, which is generally seen coloured and opaque in its crustaceous state, is at first transparent, and through it the wings, limbs, and antennæ of the butterfly, are clearly perceptible. *M. de Reaumur* collected several hundreds of these worms before their transformation, and placed them together upon a table, where he had many opportunities of examining them as they passed from the one state to the other: It was then that he distinctly perceived all the different members of the butterfly, before the chrysalis had assumed its hard and apparently inanimate state*.

After having remained for some time in this torpid state of a nymphe, chrysalis, or pupa, the limbs of the animal acquire sufficient strength to perform their functions; and it employs them in breaking open the second prison. On this event all the members are set at liberty, and instantly assume that posture and arrangement which is most suited to the new functions with which they are now to be charged: By these different processes does the butterfly arrive at that state in which it possesses all the faculties which are enjoyed by the most perfect of its kind.

All insects do not undergo the same number of transformations before they arrive at the winged state.

Some

* Vide *Memoires pour Servir a l'hist. des insectes*, tom. i. p. 354.

Some, immediately on leaving the egg, assume a form pretty nearly resembling that which they possess after their growth is completed. The whole order of aptera, which comprehends all the different kinds of spiders, come under this denomination: The viviparous insects, in like manner, appear at first, under their most perfect form. Some kinds, without undergoing all the changes of the silk worm, or that of the common butterfly, after having grown for a certain period, deposite a covering in which their wings were enveloped, and ascend into the air. Previous to this change, however, these enjoyed the power of locomotion by means of their limbs, and in that state were distinguished by voracity and activity: Of this description are all the different species of locusts. The flies, wasps, and bees, constitute another class, which, after leaving their vermicular form, and after passing into their chrysalis state, display their limbs and wings without being capable of using them. The last and most complete example of transformation is displayed by the class of moths and butterflies. On leaving the egg, and even before it, they assume the form of worms, which they again change for that of the nymphe, aurelia, or chrysalis: and it is not till they have lived a considerable time under this form, that they throw off a second covering, and come forth winged insects.

One of the most wonderful circumstances in the economy of insects, is the different preparations which they make, and the expedients to which they have recourse for their preservation in their aurelia state. Many dig a hole in the earth, where they remain during the whole period of their inactivity. This is the invention of all the coleopterous insects, or such as have crustaceous wings. The

gnats, on the other hand, go into water, where they remain till the period of their winged state arrives. Some eat their way into seeds and fruits, where they undergo the different changes previous to their appearance on wing. Many lodge themselves in animal bodies on the approach of their transformation; several of the aquatic tribes bury themselves among sand, encrusted with a glutinous substance; while the numerous race of phalanæ wrap themselves up in the leaves of trees, the bombyces, or larger kinds, constituting for themselves a silken web, to protect them during that trying vicissitude of their lives.

In general, all insects provide for their security before their helpless state arrive, by retiring from their usual haunts into some sheltered retreat. It is thus that the worm of the butterfly provides for its safety, by betaking itself, while it has yet the power of motion, to the hole of a wall, or the eave of a house: There some are suspended by a thread, which nature assists them in providing; some hang by the head, others by the opposite extremity, and many by the middle. The crustaceous covering with which they are then clothed, affords another instance of the attention paid by nature to the preservation of her offspring, during a period when they are not able to avoid external injury by flight. Thus protected by the munificence of providence, myriads of animals sink annually into a state of torpor so profound as appears to threaten the extinction of every vital power. At the return of Spring, however, all nature seems again to quicken into life; her servants awaken from their torpid state, and enter upon their functions with enlarged powers.

SECT. VI.—*Of the Habitation and Food of Insects, and their Uses in the Economy of Nature.*

It has been asserted by *Aristotle*, that every kind of quadruped and bird was inhabited by its peculiar insect *; and this assertion, which has never been contradicted, seems to admit of being much extended. We have already seen, in a former part of this work, that the salmon and cod were at certain seasons infested with insects; the same is probably the case with many other species of the finny tribe, whose history is less completely known. Some particular animals afford food and residence to different kinds of insects; and the same is the case with plants. As one animal is often seen to feed upon and inhabit a great many different plants; so the same plant often supports a variety of insects. The oak, in this country, affords sustenance to twenty different species of these animals; and there are varieties of this tree in warmer climates, that serve for food to a far greater number.

Plants afford the most general and copious pabulum for this tribe of the animal kingdom. Wherever any insect is found indigenous in a country, there will always be found in it plants accommodated to its wants. There are many insects attached uniformly to one plant; the silk worm always gives a decided preference to the mulberry,

* *Historia Animalium*,

berry, but will live and propagate, though less vigorously, upon the common lettuce.

There are other instances of the attachment of insects to particular plants, equally constant with that of the silk worm; and by means of these, the animal is often known from the place where it was found to reside. Hence *Linnaeus* has frequently given them names from the plants upon which they feed; a method often fallacious; since, perhaps, the greater number reside indiscriminately upon several plants, and support themselves upon a variety of different vegetable food. Some are asserted to be capable of residing in the human intestines, and undergoing their transformations there; being ejected from the stomach in their winged state.

The most poisonous herbs afford food to insects equally with those that are salubrious: The water-hemlock, which is considered as the strongest vegetable poison, is much frequented by many of those animals, and seems to constitute their favourite nourishment.

In the different stages of their lives, insects are distinguished by various degrees of voracity; many of them in their larva state are most insatiable: The different species of the butterfly and silk worms are then endowed with teeth, with which they make great havock among leaves, even though of a pretty strong consistency; their stomachs in that state being capable of dissolving these harder substances. The same animal, when a chrysalis, loses all appetite for food, and those instruments that were employed in comminuting it. The teeth are deposited with its first covering; and the inner coats of the stomach are voided, it is said, along with the excrements, a short while before the first transformation*. After being liberated from their

* *Memoir pour servir l'hist. des insectes par M. de Reaumur.*

their last state of confinement, the butterflies are far inferior in voracity and in the powers of digestion; their food being then a thin liquid substance collected from the leaves of plants, and devoured only in small quantity.

The same is the case with the different species of locusts; some of which in their larva state are the most voracious of all animals, and desolate entire provinces. It is not till they arrive at their winged and more perfect form, that their depredations cease, and mankind are relieved from one of the heaviest calamities which fall upon the human race in the sultry climates. It is by insects in their larva state that the roots of corn are perforated and devoured in more northerly countries. If the season prove cold and wet, they continue long underground in that state of voracious vermine; and the crop, in the mean time, is so completely atc away, that in some instances, scarcely a tenth stalk survives their depredations. In a more genial spring, these animals continue for a shorter space in their aurelia state; and the damage done by them is proportionably less; their destructive operations below ceasing as soon as they are enabled by their wings to rise into the air, and go in quest of sustenance in another element.

Insects, even in their winged state, all take food in a greater or lesser quantity; it seems, however, to be of a more delicate nature, being often only the liquid substances that exude from vegetables. Some are said, indeed, to be so short-lived, that they do not require any sustenance, and have, as it is asserted, no mouths: Of this kind are the sphemera, the may-fly, and the gad-fly. This fact, however, would require a more accurate degree of examination, and more satisfactory proof than

has ever yet been adduced, to establish it. The smallest and most delicate insects, for ought our senses can discover, may find various particles of matter floating in the air that may serve for their support; the effluvia continually emitted by animal and vegetable substances in a state of putrefaction, probably support many of this class: We know at least, that several fishes are capable of living upon the earthy particles that are found floating in the purest water; and if animals of that superior size are thus supported, there can hardly be any room to doubt that insects, many of whom are scarcely perceptible, may find abundant subsistence in the air, impregnated as it is with various effluvia.

The economical-uses of insects, and their noxious effects upon the various objects of human industry, have already been considered *; it now remains, that we point out the purposes which they serve in the general system of nature. A class of beings by far the most numerous upon the face of the globe, and however small taken individually, yet forming collectively a mass of organised matter, superior in bulk to any other department of the animal kingdom, every person will admit, could not be originally formed for no purpose, nor continue to be propagated without answering some important uses in the economy of nature.

The first and most obvious use of this part of the animal kingdom, seems to consist in that large supply of provision which it affords the superior ranks of animated beings. It is for this important purpose that the whole surface of the earth is annually covered with plants and herbage; and many, perhaps the greater part of the larger animals are supported by the immediate produce

* Sect. I.

duce of the vegetable kingdom; not a few, it must be allowed, are also sustained by devouring animal food. Between these two species of nourishment there is a wide difference; and insects afford a species of nutriment which seems to partake somewhat of the nature of both, and which supplies the wants of an infinite number of creatures whose constitutions are not wholly adapted to either. Many kinds of birds live upon hardly any other food. What a blank in the feathered race would ensue, were this copious source of provision shut up from that part of the animal kingdom! The fishes seem still more dependent on the supplies afforded by those numerous tribes of insects that either float upon the water, or are seen hovering over its surface. The whale, the largest of nature's animated offspring, as we have already had occasion to observe, is supported solely by an insect which it finds floating upon the waves. Among this class also, an inconceivable diminution of numbers would necessarily ensue, were the food of insects denied to the inhabitants of the water. Farther, many of the larger insects prey upon the smaller; all these, as well as the different animals they support, must be unavoidably struck out of the family of nature the moment this species of support is withheld.

By means of the food of insects, therefore, a large proportion of the superior ranks of animated beings are supported, all which would of necessity perish, were this order of animals destroyed. What a dreadful chasm in the works of nature would the annihilation of a class of beings occasion, which of itself constitutes so large a proportion of her living productions, and which preserves the existence of so many more! The air, the earth, and the sea, which, according to the present system, teem with

life, would thus be more than half depopulated ; and that great vivifying principle by which nature is actuated, and by which life is multiplied and carried on in all the elements without a pause, would then be exerted in a great measure in vain.

But besides the supply of food which insects afford to the superior animals, and their proving the grand instruments in the hand of nature by which she supports life throughout her dominions, they have always been deemed serviceable in the general system, by preserving the salubrity of the air. Over the whole surface of the earth, those numberless productions that enjoy either animal or vegetable life, are continually falling into decay, and making room for that succession of organized beings with which nature constantly teems : Hence, it has been supposed, that the atmosphere would soon become unfit for the support of life, did not millions of insects continually consume the carrion, and other substances in a state of putrefaction, and purge the air of the noxious effluvia emitted from them. It is probably the office of those small insects who escape our observation, to destroy those noxious particles with which that element is impregnated, and which at certain seasons render it pestilential. The operation of this class of animals upon putrid substances, is much more considerable than a superficial examination might suggest. It has been asserted by the most judicious and discerning naturalists, that the produce of a dozen of flies will consume a dead carcase in a shorter space than a hungry lion. If this be true, what beneficial effects may be produced by that inconceivable number of insects, which in warm countries continually swarm in the air ?

CHAPTER II.

ORDER I.—*Coleopterous Insects.*

THIS order comprehends all those insects which have their wings covered by crustaceous elytra, and is divided into three sections, distinguishable by their antennæ: The first includes such as have their antennæ in the form of a club, thickest at the farther extremity; the second comprehends those whose antennæ are filiform, or of equal thickness throughout; and the third is reserved for those insects that have cetaceous antennæ, tapering from the base to their extreme points. There are thirty genera of coleopterous insects enumerated by *Linnaeus*, which include under them about eight hundred different species*.

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* Vide *System. Naturæ*, p. 541, et seq.

GENUS I.—*Scarabæus*. *The Beetle*.

FORMERLY, the name *scarabæus* was applied by naturalists to all insects whose wings are covered by a crustaceous elytra; *Linnaeus*, however, has discriminated these animals, and confined that term to this single genus. The tribe of *scarabæi* are characterised by the antennæ, which terminate in a club, and are divided longitudinally into different plates or *laminæ*. The second joints of the foremost pair of legs, in most subjects, are dentated*.

The *larvæ* or caterpillars of the greater part of this genus lead a sedentary life under ground; residing most frequently in earth, while in a state of fermentation by a large quantity of manure. Pure dung is the favourite food of many; and it is in its immediate vicinity that they chiefly delight to dwell. The cockchafer, the most common of all the beetle tribe, is produced from the ova of the female deposited under ground, where it remains during the whole of its larva state, devouring the roots of plants. In this destructive occupation the garden beetle, and all the hairy *scarabæi* are employed, till the period of their emancipation arrive, when they take wing, and, forsaking the roots, betake themselves to the leaves of plants†. No calculation can ascertain the mischiefs produced by these animals, in counteracting the labours

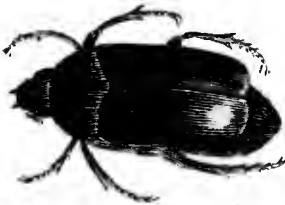
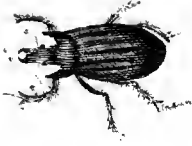
* Syst. Nat. ubi supra.

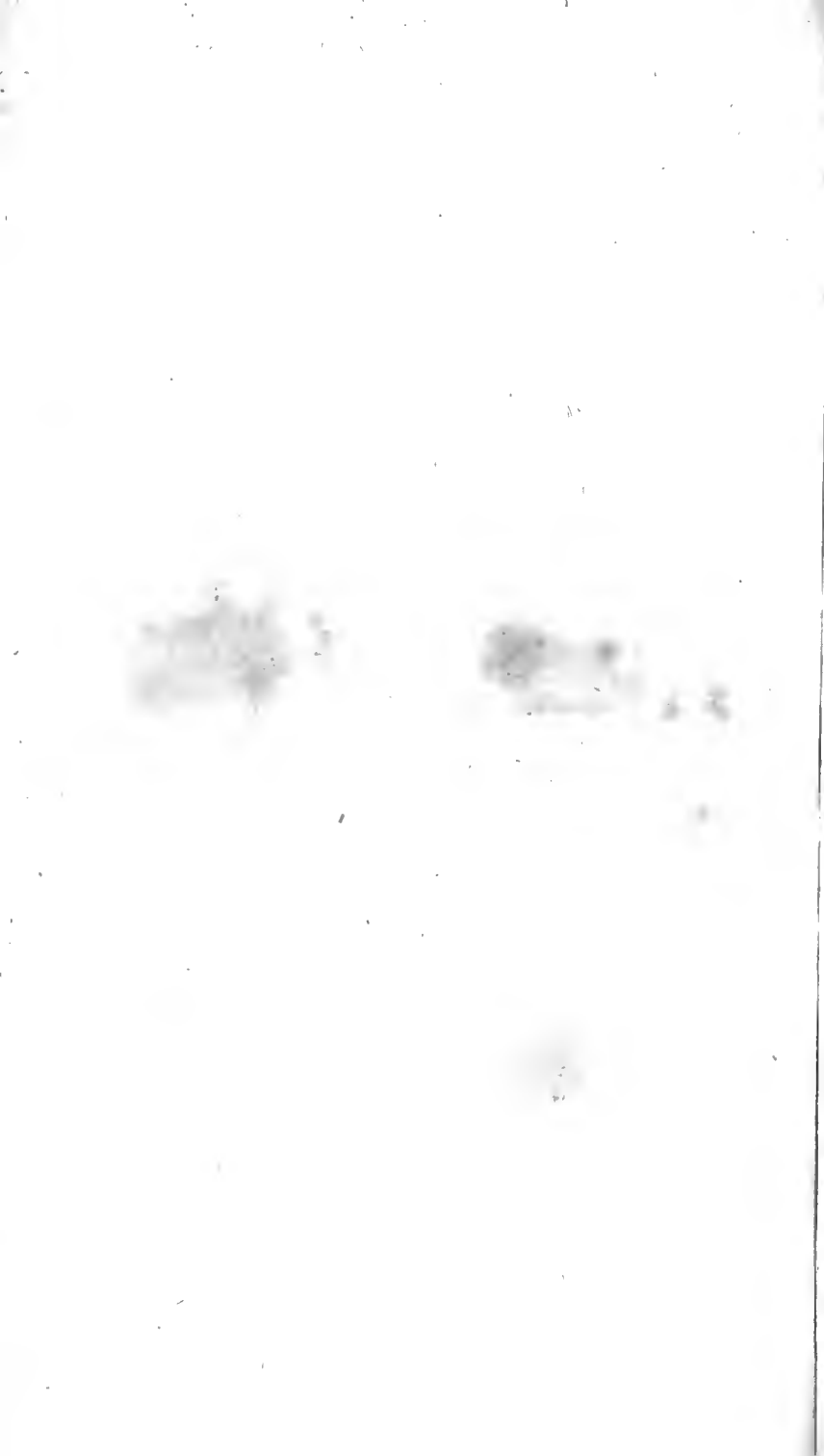
† Barbut's Genera Insectorum; p. 14.

Plate I.

ORDER I.

GENUS I.
SCARABÆI, BEETLES.





labours of the husbandman: The more industrious he has been, and the richer his fields are, the more is he exposed to their unwelcome visitations. Those which have obtained the name of *pilularii* delight in the filthiest matter; and they have obtained that appellation from those round balls of excrement which they form, in order to deposit their eggs. Happily for the scanty productions of these northern climates, only a small proportion of these nauseous and destructive insects are produced there: fewer, perhaps, are found in *Britain* than in the corresponding latitudes upon the continent.

Of the *scarabæi*, properly so called, there are three distinct families: In the first, the thorax is armed with horns; the second has horns upon the head, and is unarmed in the thorax; in the third, both the head and thorax are without horns. Some of the insects belonging to each of these families are *scutellati*, or furnished with that part called the escutcheon, while others belonging to each of them are without it. Our enumeration shall comprehend a species belonging to each of these families.

The Bull-comber.*

THIS species is not very frequent in *Britain*; and is of a very singular conformation. The body is broad and short; the elytra have longitudinal streaks that disappear
2
gradually

* *Scarabæus Typhæus*, Lin. Syst.

gradually as they proceed along its sides; the head projects forward, and the antennæ are very apparent. The colour of this insect is black, except the inferior parts of the body, which are partially covered with a few vibrissæ of a brown colour. What particularly distinguishes the typhæus is the peculiar form of the thorax; the two lateral points of which project beyond the head, having a small protuberance upon the side, whilst the middle point is shorter and somewhat raised. These long projecting horns seem given to the insect as offensive weapons, although it is incapable of using them: It is not always that the members of this tribe of beings are applied to the purposes that seem most obvious and natural to the observer.

The resemblance which these thoracic horns bear to the long spears carried by the soldiers of the *Macedonian* phalanx, has occasioned the name of phalangist, which the *French* naturalists apply to this insect. The larvæ of the typhæus is most commonly found in cow dung, where the grown animal is also frequently to be seen, both for the purpose of collecting food and depositing its eggs.

The Dung-beetle.*

THIS scarabæus is remarkable for choosing the most filthy residence, heaps of dung and excrementitious matter.

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* *Scarabæus pilularis*, Lin. Syst.

There are several other species nearly resembling it, in the impurity of its habits, as well as its external form, viz. the blue scarabæus, with the elytra and back smooth, and the head armed with a rhomboidal helmet prominent at the top†: The scarabæus of an azure colour on the head and thorax, black legs, and pale coloured elytra‡: The scarabæus of an oval figure, and black colour; the body smooth, and the elytra striated: And the scarabæus, whose head and thorax are black and without hairs, the legs pale||.

These and many other pilular beetles are enumerated in the fauna swedica of *Linnaeus*; their size and form are not very different, while they are characterised by the same manners: They prowl continually amid every kind of filth, some of them having the same nauseous smell with the impure substances which they devour.

The dung-beetle, which is here selected for description, is smooth and of a black colour above, some mixed with green; on the lower side there are a few straggling vibrissæ. The head resembles a hood, raised in the middle, and projecting at the edges: The jaws extend beyond the head. The thorax has a groove in the middle; its circumference is marginated, and its figure is round and smooth. The elytra are ornamented with a great number of longitudinal streaks: underneath the colours are various and brilliant, consisting of different shades of blue and green. There is observable on the anterior thighs, a spot formed by some red hairs, which, however, in some subjects is wanting. The tarsi appear weak

† *Système Naturel du Règne Animal*, Ord. i. gen. i. spec. 14.

‡ *Idem ibidem*, spec. 15.

|| *Rai, Insecta*, p. 166.

weak and slender in proportion to the thighs, and this is uniformly the case with all the feet *.

The Golden-beetle †.

THE last species of the beetle is deemed the most beautiful of the *English* insects. The whole body is of a glossy green, tinged with yellow; underneath, these colours partake of a shade of red, which some naturalists have compared to leather, others to finely polished copper ‡. In the brilliancy of its hues it rivals the emerald, and has sometimes been distinguished by that name.

The scarabæus in its vermicular state remains on the surface of the ground, or covered to a little depth with the mould; there it preys on the roots of tender plants. After it is transformed into a winged insect it chiefly delights in the flowers of the rose and piony: It is consequently an inhabitant of the gardens, where its transient beauty is reckoned a small compensation for the mischief of which it is guilty §. In the impure abode of the dung-beetle, that animal may be less pleasing to the spectator; but in return it is productive of less harm, and is less exposed to injury in a dwelling, of which it remains the unenvied possessor.

* Barbut. *Genera Insector*, p. 13.

† *Scarabæus auralus*, Lin. *Syst.*

‡ Vide *Regne Animale*, Tom. ii. p. 8.

§ Idem ubi supra.

GENUS II.—*Lucanus*.

THE animals of this tribe are the largest *British* insects ; They are distinguished by the antennæ, which terminate in a knob, flattened on one side, and divided into a number of pectinated *laminae*. The jaws are extended beyond the head, incurvated, and beset with teeth*.

The lucani feed upon the liquor that exudes from oaks, which they suck with their tongues. The females deposit their eggs in the trunks of decayed trees, such as the oak and the ash. The larvæ or grubs lodge under the bark or in the hollow of old trees, which they gnaw and reduce into a fine powder, and there transform themselves into chrysalides. They are found all over the island of *Great Britain*, but most frequently in *Kent* and *Sussex*†. With the noxious effects of these animals on growing timber we are not acquainted ; but notwithstanding their enormous size, it is probable that they are far less destructive than those that prey upon the roots of corn.

* *Syst. Nat.* p. 559.

† *Barbut Gen Insect.* p. 17.

The Stag-beetle *.

THIS beetle is readily distinguished by its superior magnitude, which entitles it to the first rank among the insect tribes: It is however characterised by another peculiarity no less singular, and that is the large moveable maxillæ, resembling in form the horns of a stag. These instruments are broad and flat, projecting from the head nearly one third of the animal's length. They have in the middle, towards the inner part, a small branch, and at their extremity are forked. Their similarity in shape to the horns of the animal above mentioned, has struck every naturalist, and has, with equal propriety, procured for the insect the appellation of the *flying stag* †.

An insect of such an uncommon size as the stag-beetle, and of such singular conformation, has attracted the notice of all the entymologists. The female is distinguished by the size of her horns, which are not above half the size of those of the male; both, however, are armed in the anterior side with small teeth, throughout the whole of their length; and both are sometimes as red as coral, which gives these animals a very beautiful appearance.

The head that supports these romantic horns, is broad, short, and irregular; and the thorax, which intervenes
between

* *Lucanus Cervus*, Lin. Syst.

† *Cervus volans*. Vide Mousset, p. 148. Aldrovand. insect. p. 151. Imperati, p. 169, and Charleton, p. 46.

Plate II.



GENUS II.
LUCANUS.



GEN. III.
DERMESTES.



GEN. IV.
PTINI.



GEN. V.
HISTER.



GEN. VII. BYRRHUS.



GEN. VI.
CYGNUS.



GEN. XI.
CHRYSOMELA.



GEN. IX.
CASSIDA.



GEN. VIII.
SILPHA.

GEN. XIII.
BRUCHUS.



GEN. XII.
HISPA.



GEN. X.
COCCINELLA.





between it and the body, is narrower than either, and margined around. The elytra of this beetle are very plain, being unadorned with either streaks or lines. The colour of the whole animal is uniformly of a deep brown.

The residence of these animals is commonly the oak; in some parts of the country they are but rarely to be met with; and though the largest of all the coleopterous in this part of the world, they are much smaller than those of the same species, in countries where woods are more extensive, and the climate is warmer. In these they acquire an amazing strength and vigour; and the maxillæ, whose ordinary office is to tear the bark of trees, are occasionally converted into offensive weapons, which are carefully avoided by such as have experienced the severity of their bite.

The Parallelipiped Beetle.*

THE body of this species is black; the horns smaller than those of the preceding, which in other respects it nearly resembles, and the body is oblong, and of that shape expressed by the *Linnaean* name, which we have borrowed †. It frequents the meadow grounds, and its

Z z 2

habits

* *Lucanus parallelipipedus*, Lin. Syst. *Scarabæus platyceros*, Rai.

† Rai Insect. p. 75.

habits are therefore probably different from those of the stag ; but very little relating to its economy is known.

Linnaeus enumerates five other species of the *lucanæ* viz. the *capreolus*, the *tridentatus*, the *interruptus*, the *carinatus*, and the *caraboides*: Of these the *hidentatus* is distinguished by three teeth, with which the thorax is armed on each side. The *maxillæ*, like those of the last species, are in the form of a crescent, prominent, and indented on the inner side. It is a *Swedish* insect, not much inferior in size to those already described, and bears a strong resemblance to them in many particulars of its economy.

GENUS III.—*Dermeestes*.

WE are now come to a tribe of beetles, much inferior in size to those already mentioned ; but of superior beauty. Many of the insects belonging to this genus exhibit a variety of the richest colouring that flows even from nature's pencil. They are near neighbours of man, and often troublesome companions : One species of the *lardarius* is destructive to meat, and is very difficult to prevent from entering into the repositories of the cook. It is a still more unwelcome intruder into the cabinets of the curious ; being very destructive to birds, insects, and other subjects of natural history, in a state of preservation. Arsenic is the most certain preventative against its depredations there. Many species of this family, as well as their larvæ, inhabit dried skins, the bark of trees, rotten wood, seeds, flowers, and the carcases of dead animals.

The antennæ of the insects of this tribe principally exhibit their generic characters. They terminate in a pectiolated club of an oval form, and divided into different plates or leaves, which seem to be united together by a small stalk. The thorax is of a convex form, and slightly margined : the head is bent inward, and, as it were, concealed in the thorax *.

* *Systema Nat.* p. 561.

The Domestic Dermestes *.

THE form of this insect is oblong, and almost cylindrical: The clytra are striated; the thorax thick and gibbous. There are many varieties in the species, differing considerably both in size and colour; some being found of a dark brown, and others of a much lighter hue. When touched, it is struck with such an apprehension of danger, that it instantly draws back its head under the thorax, and its feet under the abdomen, remaining motionless in that position till the danger is over †.

Of all insects this is the most destructive to wooden furniture, where it is found in vast numbers, their larva state perforating it into those small round holes that appear on the external surface, while the inner parts are reduced to powder. There are few kinds of wood so hard as to be proof against the attacks of these animals, after they have remained long enough out to be drained of their natural juices. It does not seem to be ascertained how the eggs of this animal came at first to be deposited in timber: it would seem, that the winged animal which produces them, has the power of perforating cells for their reception; but it is evident, that the young in their larva state have a much greater degree of voracity, than the perfect animals, which are seldom found devouring

* *Dermestes domesticus*, Lin. Syst.

† Earbut genera insect.

ing furniture, in comparison with those worms which no invention has been able to destroy. The acrid varnish, which is now extracted in such abundance from coal, promises to be the most effectual remedy against their encroachments*.

Dermestes Lardarius †.

THIS insect is of a black colour, and easily distinguished by a large transverse stripe covering the anterior part of the elytra, which is of a cinereous hue. The stripe receives this pale colour from a number of small gray hairs which grow upon it; it is irregular at the edges, and intersected through the middle by a small transverse streak of black spots, three in number, on each side of the elytra; the middle spot somewhat lower than the rest, gives the black streak a serpentine or undulating form ‡.

This animal feeds upon cadaverous carcases, and meat verging to a state of putrefaction: It makes its way into the museum, and is seen among preparations, in numbers more than sufficient to gratify the curiosity of the possessor. In fact, it is among the greatest enemies of his labours: and in the larva state, makes the greatest havock among the collections of insects §. It then assumes

* Vide Chap. 7. sect. 1.

† Scarabé Dissequeur noir, Regne Anim.

‡ Barbut gen. insectorum.

§ Regne Animale, Ord. 1. gen. 2.

sumes the form of a hairy oblong worm, which is divided into segments alternately of a dark and light colour. In that form it is often found deeply penetrating into old bacon, which it renders useless.

The insects of this genus are extremely numerous; *Linnaeus* has enumerated thirty species, and is probably far from having completed the catalogue. They are of sizes and colours too various even for the pencil to describe: In their manners, however, there is a strong resemblance; most of them inhabiting dung or putrid flesh. The beautiful tints displayed by some, overcome our aversion to their impure habits: The violet dermestes exhibits the most brilliant shades of that colour*. The thorax is covered with greenish hairs; the legs black, forming upon the whole a pleasing object, if we could forget that its residence, both in the larva and perfect state, is in the bodies of dead animals.

2

* Syft. Nat. Ord. i. gen. iii. spec. 13.

GENUS IV.—*Ptinus*.

THIS genus is characterised by its filiform antennæ, the extreme articulations of which are longer than those nearer the animal. The thorax is without a margin, rounded, and affords a receptacle for the head, into which the insect frequently draws it *. There are probably many varieties of this tribe which, from their extreme minuteness, escape observation: *Linnaeus* has enumerated six different species, whose habits nearly resemble those animals last described. They attack household furniture, cloths, furs, and particularly dried animals in a state of preservation. Some of them when caught, have the artifice to counterfeit death. They draw in the head and limbs, and remain till the danger is over in a state of inaction, from which nothing but the application of heat can rouse them.

In order to deposit their ova they retire among hay, dried leaves, and other substances of a similar nature: from these retreats their larvæ issue, and penetrate rotten wood, and decayed household furniture †.

The *ptinus pectinicornis* is the first species enumerated in the system of nature; it is produced from a small worm that lodges in the rotten parts of the bark of trees, where it makes a deep hole. The worm is there trans-

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formed

* *Idem*, gen. 4.† *Barbut's Gen. Insect.* p. 23.

formed into a winged insect, which has obtained its name from the form of the antennæ, being pectinated on one side. The elytra and thorax are of a deep clay-coloured brown; the antennæ and legs are of a paler shade of the same colour.

GENUS V.—*Hister*.

THERE are six species enumerated under this genus, all varying in size, but uniformly of a dark colour; in some the elytra are striated, in others spotted; while some are smooth and uniform in their colour. The larvæ, as well as the winged insects of this genus, reside most frequently in the dung of horses and cows, and often upon sand. The general characters in which they all resemble each other, are drawn from the shape of the antennæ; the last articulation of which is larger than the others, and terminates in a solid knob; while the first articulation is compressed and incurvated. The mouth is forcipated; the head drawn back within the body; and the fore-legs are dentated*.

The hister unicolor is one of the most beautiful insects belonging to this tribe: The body is black, polished, and brilliant. The figure of the animal is almost square; the thorax large, and highly polished, having a slight margin that bounds its circumference. The anterior part is formed with a slope, into which the head is withdrawn, so completely, that it is only perceptible by the projection of the maxillæ. From this situation of the head, the insects of this genus often seem altogether deprived of that part. The elytra end abruptly, as if cut away by the middle, before they reach the whole length of the abdomen: They are smooth, having only a few striæ on the outer side, that are scarcely perceptible†.

* Systema Nat. ord. 1. gen. 5.

† Barbut Genera Insectorum.

GENUS VI.—*Gerinus*.

THERE are only two species belonging to this family of insects; the *Natator* and the *Americanus*; both easily distinguished by their form, as well as their manners. The antennæ are clavated, stiff, and shorter than the head: The hinder legs are also short, flat, and very broad. These animals are said to have four eyes *, two on the upper and two on the under side of the head; they appear in fact, on both sides of the head, but their number is only two.

The *gerinus natator* has an *English* name, being known in this country by that of the water-flea. It is that small animal which is seen describing circles on the surface of the water, by running on it with great swiftness. When an attempt is made to take it, it plunges below and eludes the grasp. The larvæ are said to be found together with those of the *elytiscus*, an animal considerably larger.

The colour of the water-flea is a resplendent black, with a shade of brown: The elytra are adorned with beautiful striæ, consisting of a number of points so minute, as hardly to be observed without the assistance of a microscope. On the hinder part of the margins of the elytra are seen, by the same means, small protuberances,

* *Systema Naturæ*.

rances, born upon pedicles, and so deciduous, that the smallest friction sweeps them away *. The feet of this insect are of a yellowish brown, and the hinder pair so short, that in certain positions the animal seems to have but two.

* Barbut Genera Insectorum.

GENUS VII.—*Byrrhus*.

THIS tribe when in its larva state, resembles the worms of the dermestes; like them also they are extremely voracious, and are but too well known to those who are employed in collecting the subjects of natural history. Their antennæ, when they arrive at the winged state, are clavated, terminating in a capitulum or knob of a solid substance and oval shape.

The *byrrhus verbasci* of *Linnaeus* is of this genus, whose elytra are so thickly set with small scales, that the black colour of them is no where to be seen. These scales were of a white colour in the subject we examined, and so arranged, that they formed three undulating stripes across the elytra; between these stripes there were others of a similar form, but of a reddish brown. The insect is sometimes to be found stripped of this scaly covering, which so disfigures it, that it can hardly be recognised for the same animal.

GENUS VIII.—*Silpha*.

THE insects belonging to this class are very voracious of carrion, upon which they deposite their ova in vast numbers. Thirty-five different species of this fertile race have already been discovered; and it is probable that many have hitherto escaped all notice from naturalists. The antennæ grow gradually thick towards their extremities; the elytra are marginated; the head is prominent; and the thorax flattened, and surrounded with a border.

The different species of silphæ vary but little from each other, either in form or colour: In *Britain*, many of them are seen early in the spring, under the loose bark of trees. The *silpha vespillo* is one of the most remarkable of this genus, from which it differs considerably in the form of its antennæ. They have at their extremity a reddish knob, formed by four small plates strung through the middle, one upon the other; the last being thicker, forms a small sharp pointed knob. The head, thorax, and body are black, charged with a few hairs of a yellowish hue. The thorax is of a rounded form, marked by several protuberances, and has the circumference terminated by a broad, flat, margin. The clytra are short, and as it were, cut across, leaving about one third of the body uncovered. Their colour is black, and variegated with two yellow transverse stripes.

GENUS IX.—*Cassida*.

IN this tribe the antennæ are nearly filiform, thickening a little towards their extremities: The elytra have a broad margin, and the head is entirely concealed under the thorax, which is flat, and forms a kind of shield to it*; a peculiarity from whence this genus takes its name.

The cassidæ that are found in *Britain* have, in their larva state, two prongs projecting from the extremity of the abdomen, with which they form a kind of umbrella of their own excrements, to shelter them from the sun and rain. When the umbrella becomes unfit for that purpose, it exchanges it for another, which is fabricated of the same materials†. These insects, which in their larva state are distinguished by manners as disgusting as those of the *Hottentots*, are afterwards transformed into the most elegant of the beetle tribe. Before they undergo their last change, they cast the skin several times; their food all the while being different kinds of thistles, and verticillated plants.

There are thirty-one species of the cassidæ already described; of these the green oval shaped cassida ‡ is the most remarkable for its beauty. Above, the elytra are wholly of a green colour, variegated with small striæ, and projecting from the body like the shell of a tortoise; underneath, the body is entirely black, and supported by pale coloured feet: It inhabits the gardens and fields.

* Syst. Nat. p. 574.

† Reaumur, Tome III. Mem. vii.

‡ Rai Inf. p. 107.

GENUS X.—*Coccinella*.

THE coccinellæ are generally distinguished by subclavated antennæ; the palpi are also club-formed, the last articulation being shaped somewhat like a heart. The body is hemispherical, the thorax and elytra margined*. They are the most brilliant insects of this order; some scarlet, others yellow, pale green; and these splendid colours are finely variegated with spots.

When the females of this tribe have been impregnated, they deposite their eggs upon the leaves of trees; and from them there are produced larvæ that are great devourers of plant lice. Their chrysalid state continues for about a fortnight, when they are seen attached to a leaf by the hinder part; their bodies bent and swollen. Their wings, after bursting the covering, soon become hard, and change from their pale colour to the red or scarlet, according to the particular species. These insects are hardly ever capable of flight; their motions appear rather like jumping than flying.

The lady-bird of the *English* is a beautiful species belonging to the tribe of coccinellæ; the elytra are red, bordering upon yellow; and adorned with two black spots, one on the middle of each. The colour of the under parts is black. This species is found on the leaves

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of

* Systema Nat. p. 579.

of trees ; and in its larva state is a devourer of plant lice *. The different species of these animals are known principally by their colour, and the number of spots with which their wings are adorned. *Linnaeus* has enumerated no less than forty-nine kinds.

* Vide Rai Inf. p. 86.

GENUS XI.—*Chrysomela*.

FROM the variety of different colours with which the insects of this tribe are adorned, they have been called *chrysomela*. There are no less than an hundred and twenty-two different species described by naturalists, distinguishable by their size, colour, and manners. They all agree, however, in having the antennæ moniliform, and increasing in thickness towards the ends: Neither the thorax nor elytra are margined*.

The chrysomelæ are to be found almost every where; some frequent the open fields; others the woods, and many the gardens. Their larva prey upon the leaves of trees, rejecting the fibrous parts; some of them destroy the grass while in that state; and there is in *Sweden* a particular species, said to be guilty of very extensive depredations on the pasture grounds. This insect, when it has reached its winged state, is of a fine glossy green, mixed with a shade of blue; the whole disseminated with a number of small spots, which form irregular striæ†.

Chrysomela sanguinolenta, has the elytra of a deep black, interspersed with small spots, which gives them the appearance of shagreen: Their margins, and the wings which they cover, are marked all along with a broad band of light red, which resembles streams of blood; the belly, thorax, and head, are of a blue colour.

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*Chrysomela** *Syst. Nat.* p. 586.† *Barbut*, p. 42.

Chrysomela cruciata †. This singular species has the elytra yellow, and marked with two black lines, resembling a cross; the head of a dark blue, the thorax brown, narrow, and cylindrical. This species is frequent at *Hamburg*, where it devours the asparagus, and is supposed by the gardeners to have been transported from *Russia* along with that plant ‡.

† Frisch, p. 27.

‡ Regne Animale, p. 26.

GENUS XII.—*Hispa*.

ONLY two species of these insects are found in *Europe*; two others are enumerated by *Linnaeus*, which are not indigenous in this quarter of the globe. They have the antennæ formed like spindles, growing gradually thicker from each extremity to the middle; their insertion is between the eyes; the thorax and elytra of this tribe form their most distinguishing character; both being covered with protuberances like spines*.

The *hispa atra* is of a deep black; the upper part of the body entirely covered with strong spines, somewhat like the shell of a chestnut; the elytra are also set thick with small vibriscæ, which makes this very small insect prove a hedgehog in miniature†.

* Syft. Nat. p. 603.

† Barbut, p. 43.

GENUS XIII.—*Bruchus*.

THIS family of insects is superior in size to the last, and more diversified : It contains seven species, having club-formed antennæ ; four palpi placed at the extremity of a short rostrum *.

The bruchus of the pea blossom frequents that flower ; is covered with ash-coloured down, forming cloudy spots upon the thorax and elytra ; the latter are so short, that they leave a great part of the abdomen exposed, and thickly covered with longitudinal streaks.

* Systema Nat. p. 604

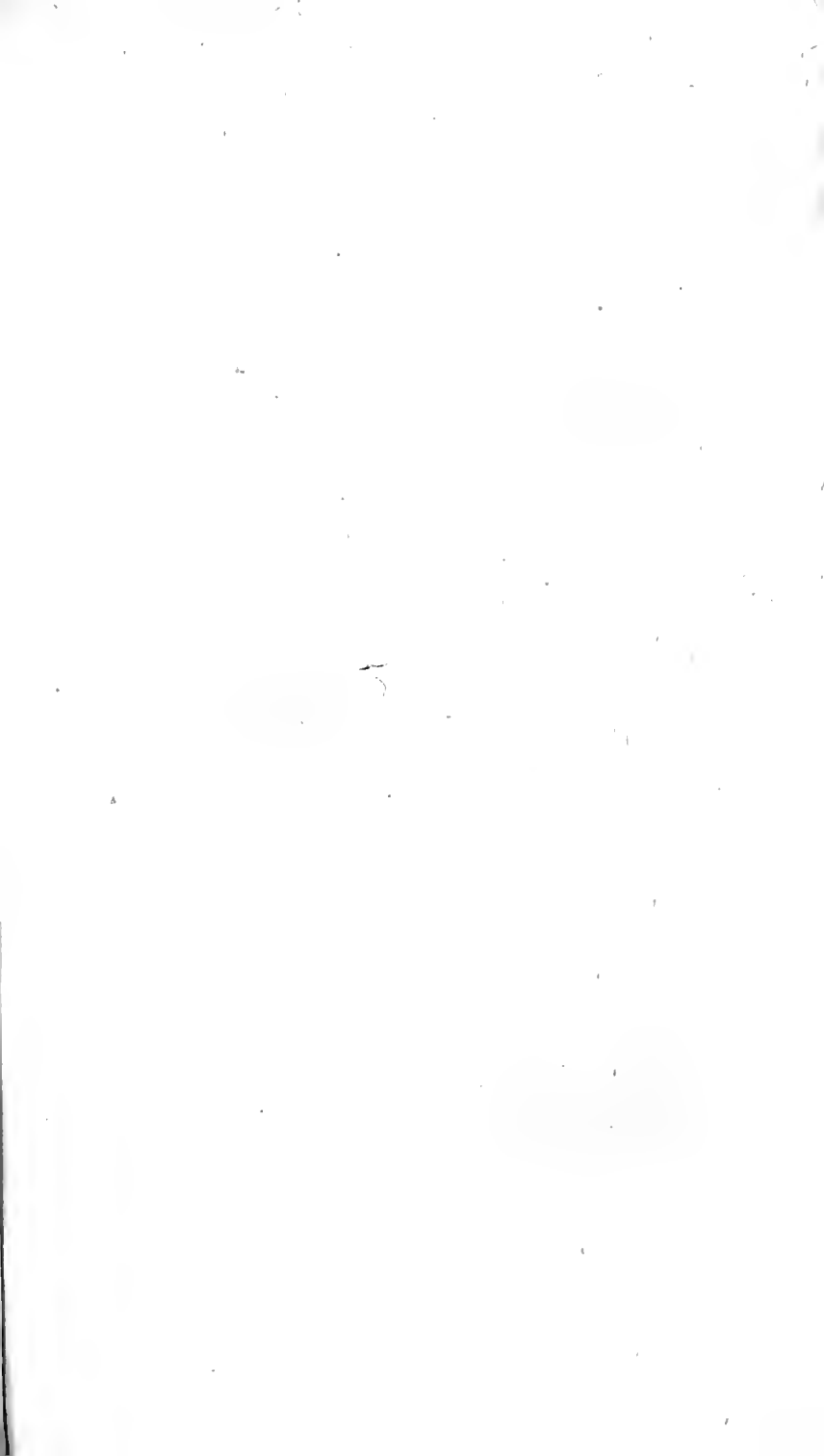


Plate III

GEN. XIV
CURCULIO



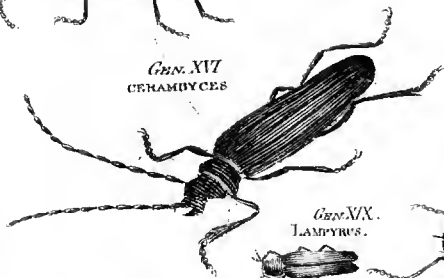
GEN. XV
ATTALABUS



GEN. XVII
LEPTURA



GEN. XVI
CERAMBYCES



GEN. XVIII
NECYDALIS



GEN. XX
CANTHARIS



GEN. XIX
LAMPYRUS



GEN. XXI
ELATER



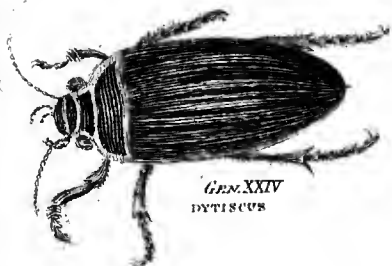
GEN. XXIII
BUPRESTIS



GEN. XXII
CICINDELA



GEN. XXIV
DYTISCUS



GENUS XIV.—*Curculio*.

THESE insects are in some parts called *weefils*: Near an hundred different kinds are enumerated in the System of Nature, a fifth part of which are found in *Scotland*. The antennæ are subclavated, and situated in a projected rostrum, of a horny substance.

As some of the birds who are supported by the fruits of man's industry repay their benefactors with a song, so the insects of this genus make some compensation for the ravages they commit; by the enchanting richness and variety of their colours. Upon them nature seems to have profusely lavished the most refulgent and vivid tints which dazzle the eye. Often, however, the curculiones peculiar to our country are so diminutive in size, that we are only admitted to survey their beauties by means of the microscope.

In their larva state, the animals of this genus are neither so inoffensive nor so beautiful, as to entitle them to the favour of man. They penetrate into the grains of corn, while yet of small size, and in proportion as they grow, they increase the boundaries of their habitation, by eating out the heart of the grain. As the number of these insects is great, the mischief they occasion in granaries and corn lofts is often very considerable. After lying for some time, the grain which they frequent is entirely consumed to the husks; and however sound it may externally

ternally appear, it is no sooner exposed to the wind, than it blows before it like chaff.

It is with the husks of grain, after they have ate the substance, that these animals are transformed into chrysalids; and when ready to come forth winged, they perforate their mansion, to make room for their escape. Beans, pease, oats, and other kinds of grain, afford food and a retreat to this tribe; many of which also perforate plants, and dwell in the interior parts; some of them mine into the leaves of trees, devouring the parenchyma that lies between the outward pellicules.

The green curculio*. This species is of a bluish green, shining with a fine resplendent shade of gold, like the neck of a pigeon: The head, thorax, abdomen, and feet, are all of this beautiful colour; the antennæ are black, having the last articulation longer than the rest.

* Pelivert. Gaza, p. 77.

GENUS XV.—*Attelabus*.

THIS tribe very much resembles the last, but is inferior in size and beauty: The animals which compose it have the head inclined, and gradually tapering towards the thorax; the antennæ increase in thickness as they approach the extremity*.

Attelabus curculionoides has obtained its name from its resembling the *curculio*; the antennæ are short, fixed on the point of the head, which is of a triangular shape, having the sharp angle joined to the thorax; the head, part of the thorax, and belly, are black; the rest of the insect is of a fine red.

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* *Syſtema Nat.* p. 619.

GENUS XVI.—*Cerambyx*. *The Capricorn*.

THE tribe of capricorn beetles owe their original to larvæ resembling soft slender worms, whose heads are scaly, and who are provided with six hard legs. These larvæ, which produce a race of the most beautiful insects, are in general white, and are found in the inner part of trees, which they perforate for a double purpose, that of obtaining food and a retreat, while transformed into chrysalids. It is from these cavities that the winged capricorn is seen issuing, as soon as it has completed its last change; and in this act it is easily caught. Many of these insects emit a strong smell, which is felt at a considerable distance; and when laid hold of, they utter a cry, occasioned, as is supposed, by the friction of the thorax and abdomen.

Cerambyx viridi-cæruleus *. This species is green, with a mixture of azure blue; the antennæ are as long as the body; each side of the thorax is furnished with a sharp protuberance; the wings are black, and the feet of a resplendent blue. It frequents the leaves of the willow, and, when approached, emits an agreeable flavour, like that of the rose †.

* Fauna Suecica & Lister, p. 384.

† Règne Animal, p. 35.

GENUS XVII.—*Leptura*. *The Wood Beetle*.

THE antennæ of these insects are setaceous; the elytra diminish in breadth towards their extremity; and the thorax is round and slender. The larvæ of the wood beetles are found, like those of the last genus, in the perforated trunks of trees, and, like them, they devour the pulverised wood when digging their retreat.

Leptura arcuata. This is one of the most beautiful of insects; when viewed with a microscope, it appears like velvet inlaid with precious stones; and if exposed to the rays of the sun, it shines with infinite splendour. The ground colour of this animal is a velvety black; the elytra are variegated with transverse bars of a bright flame colour, formed by streaks of down, of a refulgent yellow*.

3. C 2

* Barbut, p. 57.

GENUS XVIII.—*Necydalis*. *The Carrion Eater*.

OF this genus there are eleven species, which have obtained their *English* name from their supposed predilection for carrion. In their winged state, they generally frequent the woods; their residence and habits, while larvæ, are wholly unknown. The generic characters of these insects are, the fetaceous form of the antennæ, and the shape of the elytra, which are either shorter or narrower than the abdomen †.

The first insect of this family enumerated by the *Swedish* naturalist is the larger carrion eater, which is distinguished by its large and prominent eyes: The antennæ are raised upright as far as the first articulation, after which they are bent, and turned aside. In some individuals, the thorax is black, in others yellow; the elytra are generally black, lighter towards the middle, which contains a lemon-coloured spot.

† *Systema Nat.* p. 641.

GENUS XIX.—*Lampyrus*. *The Fire Fly*.

THESE insects are characterised by filiform antennæ, flexible elytra, a round flattened thorax, surrounding and concealing the head; the females are, in most species, without wings †. It is the female of one species of these insects that is in this country termed the glow-worm, from that phosphorescent light which it emits during night. Two or three of these animals inclosed in a glass vase, will give a light sufficient to enable a person to read in the darkest night.

This singular phenomenon is observed most frequently in the month of June, when the animal is in motion. The female can withdraw or display this light at pleasure, by contracting or unfolding her body; her purpose in shewing it is said to be in order to attract the male. When crushed with the hand, this luminous substance of the glow-worm adheres to it, and continues to shine till it is dried up.

The noctiluca, or glow-worm, in its insect form, possesses elytra, and wings under them, longer than the body. The head and antennæ are black; the former entirely concealed by the broad plate of the thorax. The four last rings of the abdomen, which emit the light, are in the male not so bright as those of the female, and are nearly destitute of that luminating quality which renders her so remarkable ‡.

† Syst. Nat. p. 643.

‡ Barbut, p. 62.

GENUS XX.—*Cantharis*.

THE insects of this family are numerous, and distinguished into twenty-seven different kinds. From the similarity of the name, some have supposed them the same with the cantharides imported from *Spain*, whose virtues are so well known in medicine; that insect, however, belongs to a different genus. The cantharis frequents flowers; its larva resembles that of the *cerambyx* already described.

All the insects of this tribe have setaceous antennæ, the elytra flexible, and the thorax margined, and shorter than the head. Like the preceding genus, they have papillæ upon the sides of the abdomen.

Cantharides ænes-viridis †. This insect is of a kind of brass green; on each side of the thorax is a small nipple, of a saffron-colour, with three tips. The thorax and elytra are of a deep green, the latter terminating in a red spot. Beneath, the insect is of the colour of brass, and red under the wings ‡.

† Rai Inf. p. 101.

‡ Règne Animale, p. 69.

GENUS XXI.—*Elaſter*. *The Skipper*.

THE insects of this genus are distinguished by setaceous antennæ, but more particularly by an elastic spine which springs from the under side of the thorax, near the extremity. By means of this spring, these animals, when turned upon the back, are capable of jumping into the air, and recovering their position.

In the state of larvæ, the insects of this genus inhabit the trunks of decayed trees, and are there metamorphosed into the winged form. Their residence is then changed, and they are seen in various haunts, flowers, thickets, or open fields.

The chestnut-coloured elater †. This insect is found both in the corn and pasture fields. The antennæ are branchy, and the tips of the elytra black; the rest of a pale flesh-colour; the thorax is covered with a fine ash-coloured down ‡.

† Lister Loqu. p. 387.

‡ Règne Animal, p. 64.

GENUS XXII.—*Cicindela*. *The Sparkler*.

THE porrected jaws afford an easy mark to discriminate the insects of this genus; they are both armed with teeth; the eyes of these animals form another striking peculiarity, being singularly prominent; the thorax is round, and margined †.

Cicindela campestris. This insect is one of the most beautiful which this country affords. The whole upper parts of the body are green, tinged with blue; underneath is a mixture of yellow, red, and copper. The elytra are delicately marked, each with small white spots. The insect, and its larvæ, are found in sandy dry situations; the latter resemble soft whitish worms, and immerge themselves into a perpendicular hole in the sand, with the head at the bottom, ready to catch the insects that fall into it. These animals are all rapacious, devouring whatever they can overcome ‡.

† *Systema Nat.* p. 657.‡ *Barbut*, p. 70.

GENUS XXIII.—*Buprestis*. *The Cow-burner*.

THESE animals, both in their external figure and manners, nearly resemble the skippers already described; their colours, however, are far more resplendent; and, when viewed with a microscope, their effulgence dazzles the eye. From this circumstance, they have obtained in *France*, where they are more numerous than in this country, the name of *Richards*.

The characters of this genus are, setaceous antennæ; the head drawn back within the thorax; the mouth armed with jaws, and furnished with palpi.

Buprestis guttata.! This elegant species is found on sandy ground, below timber that has begun to rot. Its head enters within the thorax, and the elytra are furrowed, and adorned each with four or five spots of a bright yellow; the upper side of the abdomen is blue*. The larvæ of this and the other species belonging to this tribe are unknown.

GENUS XXIV.—*Dytiscus*. *The Diver*.

THIS genus comprchends twenty-three species of aquatic insects, mostly of a very large size ; they are distinguished by the antennæ, which are either setaceous, or terminated by a perfoliated knob ; the hind legs are armed with claws, and furnished with vibrissi, that enable the insect to swim *.

The divers have obtained their name from the sudden escape they make from danger, by plunging into water. By day, they frequent the stagnated pools, from whence they issue in the evening, to make excursions on the wing. The males have furrowed elytra, while those of the females are plain. The latter, when impregnated, deposits her eggs in the water, wrapped up in a silky cod, of a texture sufficiently strong to protect them from predatory insects, especially those of their own kind, which are mutually rapacious. Their larvæ are worms consisting of eleven segments, distinguishable by the largeness of their heads, and by four filiform antennæ ; they devour other water insects, and even each other. When arrived at their winged state, their bodies are protected by a hard scaly coat of mail : If caught unguardedly, they are in that state capable of giving a severe bite, as well as of wounding the hand with a sharp spine.

Dytiscus

* Systema Nat. p. 664.

Dyticus piceus. This is one of the largest of the tribe ; all over of shining black ; the antennæ are of the shape of clubs, and perfoliated. Their colour, and that of the four palpi, is brown ; the head of this insect is flattened, and furnished with a pair of formidable jaws.

GENUS XXV.—*Carabus*. *The Ground Beetle*.

IN this family, which contains no less than forty-three species, are found some of the largest of the *British* insects. They are characterised by setaceous antennæ, and by the shape of the thorax, which resembles a heart; the point cut off and margined. The elytra are likewise surrounded with a margin*.

In their winged state, the heads of these animals are prominent; their mouths, like those of the preceding genus, are armed with jaws, and four palpi. Their eggs are deposited under ground, or in decayed trees, where the larvæ reside till they are metamorphosed. It is during their caterpillar state, that they are prejudicial to gardens, and hence have been ironically called gardeners by the *French*†. It is not, however, vegetable productions alone that they devour: They are the greatest tyrants to other insects, and destroy indiscriminately, as many as their strength enables them to overcome.

Carabus violaceus ‡. This species is of an oblong shape; the colour a dark violet: The edges of the thorax and elytra, are violet with a shade of purple. The latter have neither dots nor streaks, but are marked with strong longitudinal wrinkles. It is found among rotten wood.

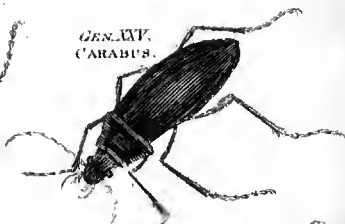
* *Systema Nat.* p. 668.† *Regne Animal*, p. 44.‡ *Rai Inf.* p. 96. n. 1.

Plate IV.

GEN. XVI.
TENEBRION.



GEN. XXV.
CARABUS.



GEN. XXIX.
STAPHILINUS.



GEN. XVII.
MELOR.



GEN. XXX.
FORFICULA.



GEN. XXVIII.
MORDELLA.

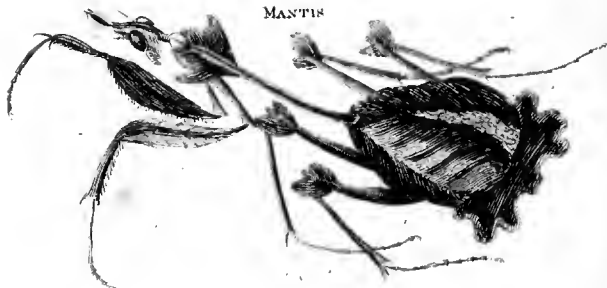


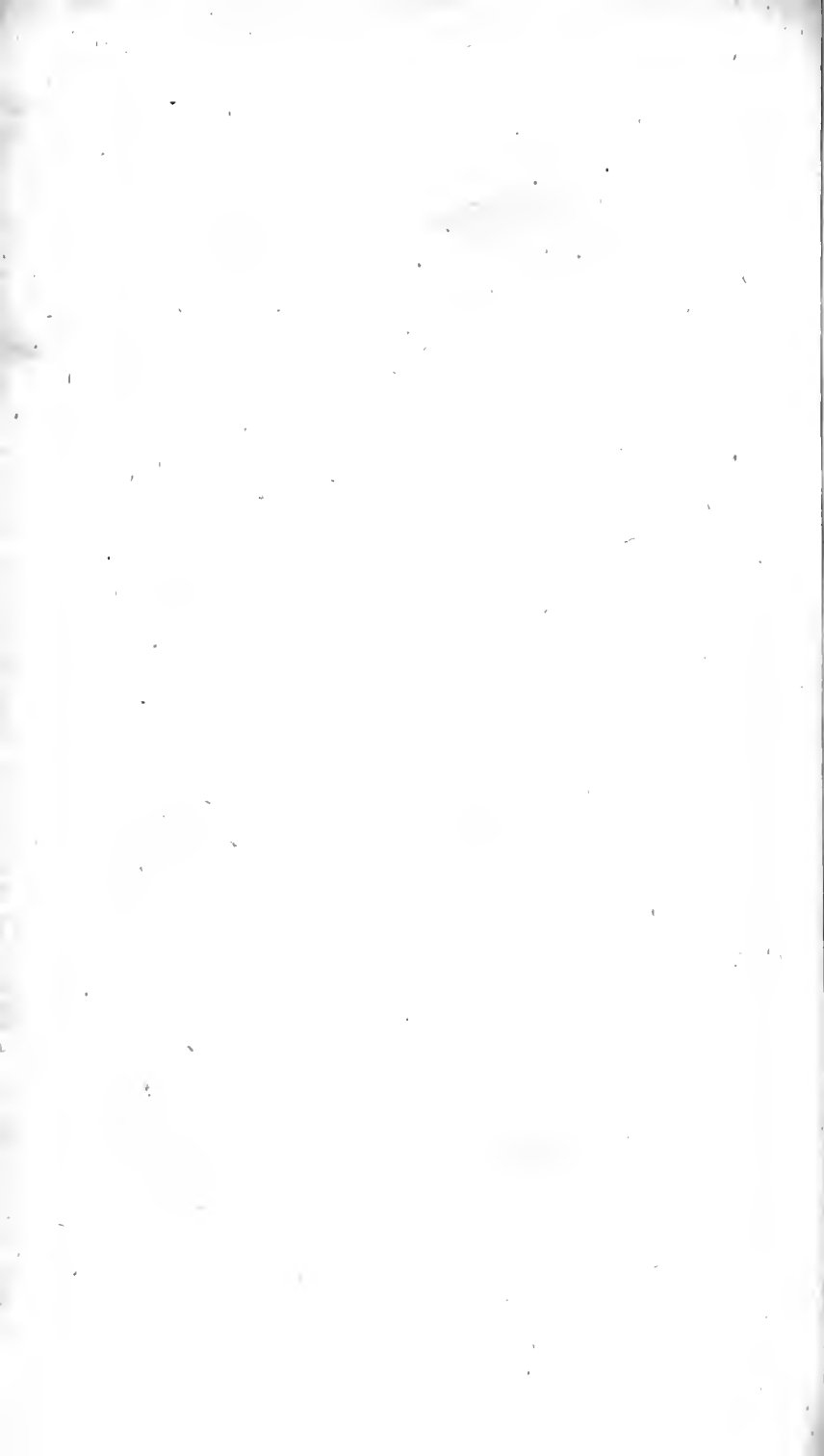
ORDER II.

GENUS I.
BLATT.



GEN. II.
MANTIS





GENUS XXVI.—*Tenebrio*. *The Darkling*.

THESE insects are commonly of a dark sombre colour : Some have wings under their elytra, while others are apterous ; and from this circumstance, they have been divided by naturalists into two sections, containing together thirty-three different species. The larvæ of some species reside among rotten sticks, or rubbish ; those of others take up their abode among flour, and different kinds of food. After they have become perfect insects, they enter houses and devour every sort of provision. Their principal resort is to damp cellars, where putrid air and darkness attract them. It is from their precipitately avoiding light, as well as their gloomy appearance, that they derive their generic name.

Tenebrio Mortifager *. This sable animal is found among rubbish and dung in gardens ; when it enters houses, as is frequently the case, the credulous believe it the certain forerunner of death. It is entirely of a deep black, without the least lustre : The antennæ are long ; the thorax margined ; and the elytra wrinkled. This, as well as some other species, is remarkable for emitting a fetid smell †.

† *Tenebrio primus* Voyage d'Alande.

† Charleton exercit, p. 48.

GENUS XXVII.—*Meloe*. *The Blossom Eater*.

IN the first edition of the System of Nature, there were only one species of this genus taken notice of; in the later improvements of that celebrated work, there are sixteen kinds of these animals enumerated; while, perhaps, a still greater number remains to engage the researches of future historians. This singular tribe, contains in it the genuine cantharis, or blistering fly, and is distinguished by having moniliform antennæ, with the last articulation of an oval shape. In all these insects the head is inflected and gibbous; the thorax round; and the elytra flexible*.

The insects of this genus are either winged or apterous; in the former, the elytra are short, extending about half the length of the abdomen: In the latter, these parts reach the whole length of the body, and conceal under them two slender wings: In all of them the antennæ resemble a necklace, composed of a number of small rings; those of the middle larger than those near either extremity.

Meloe proscarabæus†. This insect is soft to the touch, and of a deep black, with a slight shade of purple towards the under part of the body. The feet and the antennæ

are

* Systema Nat. p. 679.

† Mouffet Edit. lat. 162.

are of a violet hue. The elytra are coriaceous, and seem as if cut through obliquely from the inner to the exterior edges, being thicker at their future than at the sides. Some naturalists have termed this species the unctuous cantharis, from that fat, oily, and fragrant substance, which exudes from the body *. This oleaginous matter enters into the composition of salve for plague-sores; and is deemed an excellent antidote against the poison of the scorpion's sting.

Meloe vesicatorius. This is the species so frequently used in pharmacy; an insect to which man is perhaps more deeply indebted, than to any individual belonging to this class of beings. The blistering cantharis is about nine lines in length; the colour a resplendent green, mixed with azure. In the southern parts of *Europe* it multiplies exceedingly; some of the provinces of *Spain* annually receive a large sum for those they export to the rest of *Europe*. They are there seen flying in vast swarms, and alighting upon trees and shrubs, whose leaves they devour. They are said to prefer the ash leaf to that of any tree in the forest; but whatever leaves they devour, they are uniformly accompanied with a heavy nauseous smell, like that of mice, and thence their haunts are discovered by those who go in quest of them.

In their humid and living state, the odour exhaled from these insects is so corrosive and irritating, that the gathering them is attended with danger. In that occupation, the labourers, who imprudently collect them in the heat of the day, and with their hands uncovered, are frequently seized with a violent heat of urine, and voiding of blood. The same accidents befall those who unwarily sleep under the trees they frequent.

The

* Dale Pharm. p. 397

The female cantharidis seems to feel the access of amorous desire in a more violent degree than the male: It is she that courts the male; and in the great act of fecundation, it is she that occupies that place, to which in most animals nature directs the other sex. After impregnation, she deposits her eggs in the ground, where they remain till they have undergone the various changes that are to bring them forth winged cantharides.

When collected and dried, these insects become so light, that fifty of them hardly weigh a dram: it is in that state they are grinded down into the well known powder, which constitutes the basis of the common blistering plaister. Of the other purposes to which they have been applied, ignorance is perhaps better than information; and we freely resign to the annalists of dissipation, the task of recording those vain attempts in which they have been employed by the enervated debaucher to restore his virility. The enterprises of love, like the fatigues of war, require certain intervals of rest and tranquillity, without which neither the lover nor the soldier can take the field without hazarding his reputation*.

* *Militat omnis amans, et habet sua castra cupido,*

Ovip.

GENUS XXVIII.—*Mordella*. *The Nibbler*.

THIS genus has the antennæ filiform, and ferrated; the head bent under the neck; the palpi clubbed, and obliquely truncated. The elytra are curvated, or sloping down towards the tail; and a broad lamina is seated at the base of the abdomen before the thighs*. There are only six species of the mordella known to naturalists; of these the mordella aculeata is quite black and smooth. The abdomen terminates in a sharp point, and extends a considerable length beyond the tips of the elytra.

The yellow mordella is of a small size, and of a dark shade of that colour. The elytra bend downwards at the extremity, where they assume a ferruginous colour: The point of the abdomen, which extends beyond them, is of an obscure black.

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* *Systema Naturæ*, p. 682.

GENUS XXIX.—*Staphylinus*.

THE antennæ of this singular tribe are moniliform: The elytra, by which they are readily distinguished, seem as if cut through by the middle, and do not extend half the length of the abdomen. Under these cases the wings are folded up, and concealed. The extremity of the abdomen is unarmed, but provided with two oblong vesicles which the insect can shoot out or retract, at pleasure.

The staphylini are sometimes seen upon flowers; but their principal resort is to the dung of cows. All of them when touched turn up the tail, as if with an intention to sting. They are, however, unprovided with that instrument, but bite severely with their jaws when laid hold of. In their larva state, these insects so much resemble the perfect animal, that they cannot easily be distinguished*.

Staphylinus maxillofus, is the largest *British* insect of this genus. The jaws, from which it obtains its *Linnean* name, are sharp, hard, and rather longer than the head. The whole insect, both above and below, is of a deep black: The elytra do not cover more than one third of the abdomen, which appears beyond them, rough and hairy. The legs are long; each of the tarsi is provided with a tuft of hair resembling a brush. This and the other species can fly by means of large wings, which unfold from under the elytra†.

* Barbut, p. 95.

† Rai Inf. p. 109. n. 1.

GENUS XXX.—*Forficula*. *The Earwig*.

THIS genus contains some species of insects that are universally known. Their common characters are fetaceous antennæ; elytra shorter than the abdomen; wings folded up and covered by the elytra; and a forceps, by which the extremity is armed*.

Forficula auricularia. This insect is seen every where; it even enters our inmost apartments. The body is of a yellow colour, inclining to brown; dark above, and lighter underneath. The forceps with which the earwig is provided, procured the generic name *forficula* to this tribe. The formidable name of 'earwig' has arisen from a notion, that these insects entered into the ears of people while asleep, and from thence penetrated into the brain, where they occasioned much pain; often madness and death: The *French* appellation, which signifies the Ear-piercer, urges this accusation in still plainer terms.

The smallest acquaintance with the structure of the human ear, will easily prove the fallacy of these suspicions, which have in all probability often cost this animal its life. It, however, destroys flowers; and wherever fruit has been wounded by stronger insects, the earwig generally attends for a second feast.

All these animals after fecundation lay eggs, from which caterpillars are produced, that differ but little

3 E 2

from

* *Systema Nat.* p. 686.

from the perfect insect. It is amazing in how little room the long wings of these animals are packed before they burst from their chrysalid state; and even after they are protruded, the animal, by means of the joints and muscles with which they are furnished, folds them up under the elytra, that you would imagine it altogether deprived of these instruments*.

The life of the earwig, after it enters upon its winged state, lasts but a few days; each sex is then constantly in pursuit of the other, and that short existence seems chiefly employed in the business of procreation: After having provided for posterity, the parent animal dries up, and dies to all appearance consumptive†.

* Swammerdam, p. 114.

† Goldsmith, p. 358.

CHAPTER III,

SECTION I.

ORDER II.—*Hemiptera*.

WE are now come to the order of hemipterous insects, which comprehends the different kinds of locusts and grasshoppers, and, in general, all those animals whose antennæ are setaceous, and heads inflexed. Their elytra and wings are extended, smooth, and semicoriaceous; being of a substance somewhat like vellum. The thorax is horizontally flattened, of an orbicular form, and margined round the extremities: The feet are formed, in most species*, for running; and the abdomen is terminated by two small appendices resembling horns. They are termed *hemiptera*, because only half of their wings appear when in a state of rest: They do not then meet together in a longitudinal suture like those of the last order, but have some part of their interior margins crossed, or laid one over the other, above the abdomen.

* *Pedes cursorii*, Lin. Syst.

GENUS I.—*Blatta*.

THIS order of insects has been subdivided into eleven different genera; the first of these is the blatta, or cockroach, which comprehends that well known species of animals which frequent kitchens and bakehouses. Their appearance is ugly and deformed; they seldom, however, present themselves by day; and though in our immediate vicinity, and of considerable size, they are but rarely seen. If surprised in their haunts while it is light, they speedily escape by running; their wings being unfit for flight, except in the males of some species who make awkward attempts at flying. The night is their season of activity, when they issue from the crevices near the chimney in quest of crumbs of bread or dough.

In this island the cockroach is probably always a domestic animal: In warmer countries, however, there are different kinds which haunt the fields in great numbers. The hakkerlac of the American isles, that voracious animal, which so greedily devours the provisions of the inhabitants, is of this genus. That insect, like our cockroach, shuns the light of day; during which it lies concealed in some hole, till darkness approach, to favour those depredations for which it has long been so infamous in the New World.

The larvæ of all the different species of blattæ differs but little from the perfect insect, excepting in the total want of the wings and elytra. In that state, meal is its
common

common food ; and of that necessary of life it is then extremely voracious. When meal is wanting, as must happen in the fields, it corrodes the roots of plants. After having attained its full complement of limbs, and acquired its most perfect form, the cockroach displays a mouth armed with jaws, and furnished with palpi. Its antennæ are generally as long as the body, and the abdomen as broad as the thorax. The tarsi of the fore feet have five joints ; those of the hinder only four ; while the horns which terminate the abdomen are furrowed, or wrinkled transversely *. There are ten species of this genus, named, for the most part, after the different countries which they inhabit.

* Barbut, Order II, Gen. I.

GENUS II.—*Mantis, or Soothsayer.*

THE insects of this genus possess a form the most romantic and extraordinary that is perhaps presented by any animated being; and so powerfully have their singular attitudes operated on the minds of the credulous and ignorant, that superstition has invested them with certain powers that are altogether unexemplified by any part of the history of animated nature. By the singular manner in which the soothsayer stretches out its fore legs, it has acquired the reputation of a diviner, who could unfold all the secrets in the bosom of futurity; and because the insect often sits upon its four hind legs, having the two fore ones raised up and folded together, the believing multitude have supposed it to be then holding intercourse with the Supreme Power, in the exercise of devotion*; a circumstance from which it has obtained from the peasants of *Languedoc* the name of *Pregadiou*, or the God-prayer. It is in that province, where these animals abound, that the country people have also ascribed to the soothsayer another very commendable quality; that of obligingly shewing the way to strangers: This it is supposed to do, by that peculiar habit which it has of stretching its fore legs sometimes to the right, and sometimes to its left side. These superstitions of the vulgar have been as favourable to the security of these animals, as they are disgraceful to human reason; for they have procured them a character almost

* Vide Goedart.

almost sacred; and the injuring them is reckoned a crime of no small enormity †.

The insects of this genus are distinguished by an unsteady nodding motion of the head, which gives it the appearance of being slightly attached to the thorax. The mouth is furnished with jaws and palpi; and the antennæ are setaceous. The four wings are membranous, and wrapped close round the body. The anterior pair of feet are compressed laterally, and ferrated on one side; their extremities terminating in a single nail. The four back feet are smooth and gressory, being formed rather for advancing slowly than for performing quick movements. The thorax is throughout of an equal size, narrow, and in some species extending to a disproportionate length ‡.

The most remarkable of these animals is the mantis gongylodes of *Cbina*. The thorax is uncommonly long and narrow; the head small and flat, with two short filiform antennæ; behind these, two large polished eyes are placed; the rostrum has the shape of an awl, but often split towards the extremity into two points. The elytra, which cover two thirds of the body of the insect, are reticulated, and crossed the one over the other; the wings which they cover are veined and diaphanous. The four hind legs have the appearance of being winged, on account of those large membranous lobes which emerge from their joints. The anterior pair are armed with spines at their first articulation, and towards their extremities they are ferrated on one side ¶.

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† Reamur, Tom. IV.

‡ Systema Nat. Ord. II.

¶ Vide Barbut's Gen. Insect. Ord. II. Gen. 2.

GENUS IV.—*Gryllus*.

THIS destructive genus comprehends all the different kinds of locusts, and is divided by *Linnaeus* into five tribes, containing sixty-one different kinds of animals. Their general characters are, a head inflected, armed with jaws, and furnished with palpi; the antennæ in some species are setaceous; in others filiform: the wings are wrapped round the sides of the body; the under one folded, and concealed under the elytra. All the feet are armed with two nails; the hind pair formed for leaping.

The tribe of *achetæ*, which comprehends in it all the different species of crickets, is distinguished by the bristles which spring from the extremity of the abdomen, and by the three articulations of which their tarsi are composed. This family have obtained their *English* name from the continual tiresome noise which they produce. The domestic *achetæ* usually take up their abode in ovens, and in the holes of walls around kitchen chimneys, where they are attracted by the heat, and are very noisy companions to the country people, who, from some prejudice in their favour, seldom wish to destroy them.

The field cricket remains, during the day, pent up in some subterraneous habitation, from whence it issues forth about sunset; when, in countries where these animals abound, the whole fields ring with their noise.

The mole cricket is by far the most hideous and extraordinary insect belonging to this tribe. It has obtained
its

Plate V.



GEN. III
GRYLLI



GEN. IV
FULGORA

GEN. V
CICODA



GEN. VI
NOTONECTA

GEN. VII
NEPA



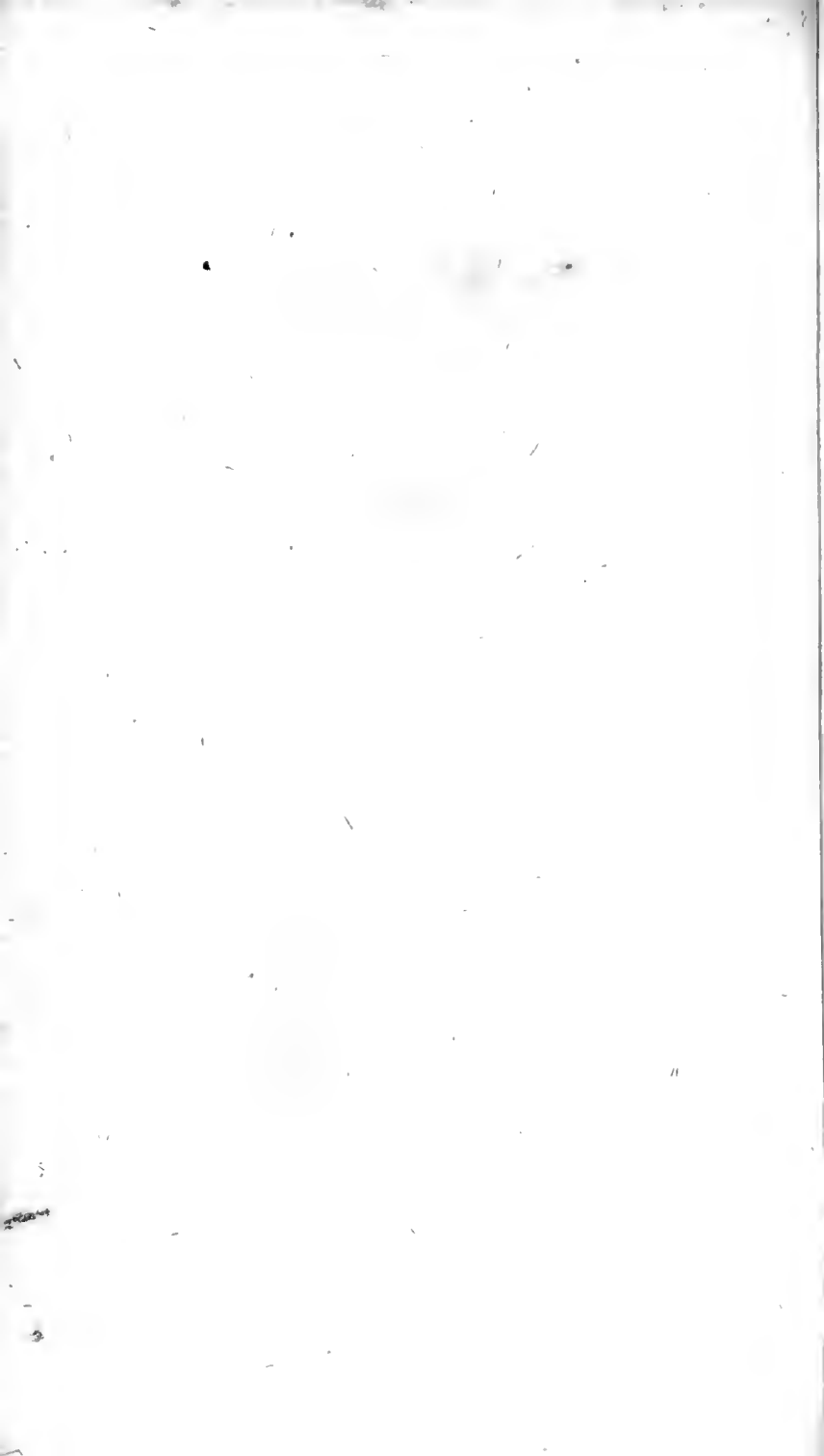
GEN. VIII
CERX



GEN. IX
APHIS



GEN. X
CHERMES



its name * from the singular structure of its fore legs, which are extremely broad and flat, and terminate in six large ferrated claws, somewhat resembling the fore feet of a mole. The whole animal is of a brown, dusky colour, very large, and active. It frequently takes up its residence in hot-beds, to the great disturbance of the gardener; for it digs under ground, like the animal after which it is called, committing dreadful havoc among the tender roots of the plants that are artificially raised there. It is frequent in *France*, where the gardeners know it by the name of *courtilliere*.

The tettigonia, or tribe of grasshoppers, is the next section into which the grylli are divided; and of it, the gryllus viridissimus is the most remarkable. Its colour is a pale green, the antennæ setaceous, and longer than the body. The elytra are clouded, and the wings reticulated; both extend beyond the body about one third of its length. The female carries, at the extremity of her abdomen, a kind of ferrated spine, composed of two laminæ, and in shape broad, and turned up like the blade of a cutlass. These implements are employed by the female in digging in the ground, or in wood, holes for the reception of her ova; and this being a function in which the male has no share, he is unprovided with the instruments by which it is performed †.

The female grasshopper possesses an amazing fecundity; she regularly deposits from four to seven hundred eggs at a time ‡. The wonderful precautions which she takes for providing them security, and food for the young as

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soon

* Gryllo-talpa, Linnæus.

† Barbut's Gen. Insect. page 115.

‡ Mémair. pour servir a L'Hist. des Insect. Tome IV,

soon as they are disclosed, merit our particular notice. With that lancet, which we have already described, she excavates a number of holes in the dried branch of a tree; into each of these holes eight or ten of her eggs are dropped; there they are surrounded with that kind of food which is most suitable for them in their larvæ state. The disposition of the eggs is in rows, and placed in the middle of the trees; the soft substance of which is the first food of the insect after it leaves the ovum. The insect that proceeds from each of these eggs, after it has grown for some time, and before reaching a size incompatible with escaping by the narrow mouth of the hole, takes a final departure from the place of its birth.

The larvæ having thus left their egg state, and acquired the use of their limbs, the two anterior of which are formed for digging the ground, soon apply them to that purpose, and excavate for themselves a subterraneous retreat among the roots of plants, which they gnaw, and support themselves upon the juices that exude from them*. In this state they remain till they are ready to undergo another transformation, which introduces them into the open air in the form of winged insects.

A short time after, the grasshopper appears in its last stage of perfection; it spreads over the meadows, which it fills with its chirruping strains, which are the calls of the male inviting the female to love. Some naturalists are of opinion that the notes of the grasshopper are produced by rubbing the two hind legs of the animal against each other. *M. de Reaumur* and *Linnaeus*, who have minutely examined these insects, derive their vocal powers from a very different source. On examining the male,

* Vide *Memoires* ubi supra.

his body has been found provided with a small hole below the insertion of each wing, delicately constructed with organs of sound within, and covered over externally with a fine transparent membrane. It is by means of these organs, which, in the completeness and delicacy of their structure, may vie with those of the human voice, that some species of the grasshoppers produce their melody. The cicada of the ancients, so famous for beguiling the labours of the husbandman by his melodious notes, is an animal very different from our grasshopper: The former either walked or flew; and it was from the summit of a tree that it pouted forth those delicate notes, so much celebrated by the *Grecian* poet *.

The note of the grasshopper is seldom heard, without being returned by another male of the same species; and the two little animals, after many mutual insults of this kind, are seen to meet and fight desperately. The female is generally the reward of victory; for, after the combat, the male seizes her with his teeth behind the neck, and thus keeps her for several hours, till the business of fecundation is performed: They are at that time so strongly united, that they can scarcely be separated without tearing them asunder †.

After fecundation by the male, and towards the close of summer, the female is seen distended with the seeds of a future family; and she prepares for depositing her numerous ova in the manner we have already mentioned. The eggs are white, of an oval shape, and horny consistency. In size, they are nearly equal to a grain of anise; and while in the body of the female, they are enveloped
within

* Vide the Odes of Anacreon.

† Goldsmith's Nat. Hist. Vol. VII. p. 334.

within a covering, branched all over with veins and arteries. In this form they remain deposited under the surface of the earth, or inclosed in wood, apparently unaffected by the rigour of winter, till the genial heat of spring begin to hatch and vivify them. Then, the sun beginning with its warmth to animate all nature, the insect eggs feel its benign influence; and generally about the beginning of May, each egg produces a larva about the size of a flea, at first of a white colour, but afterwards gradually turning brown.

After having taken these measures for perpetuating her kind, the parent animal does not long survive; as the winter approaches, she dries up, seems to feel the effects of age, and dies from a total decay. Some assert that she is killed by the cold; others, that she is eaten by worms; but certain it is, that neither male nor female are seen to survive the winter.

When examined internally, the grasshopper discovers a very singular and complicated structure of viscera; besides the gullet, there is observed a small stomach; and behind that a very large one; still lower down, there is yet a third: So that it is not without some foundation, that all the animals of this tribe have been supposed to chew the cud, as they so much resemble ruminating animals in their internal conformation. *Aristotle* informs us, that they were greedily sought after as a delicate morsel by the *Greeks*; and that the season when they were deemed most delicious was a short time before they left their chrysalis state*. The metamorphoses from that state is performed with great difficulty and agitation; many perish in this severe effort of nature, and those who survive are for some time in a languid and debilitated state†.

* *Historia Animalium.*

† *Reamur, Tom. IV. p. 188.*

SECTION II.

THE locusts occupy the next section of this genus; a race of animals, unhappily for mankind, by far too well known by their destructive effects on the productions of the earth in many of the warmer regions of *Asia* and *Africa*. They are distinguished by a simple tail, and filiform antennæ*. The former of these members is destitute of those setaceous bristles which characterise the *achetæ*, and of the tube which is peculiar to the *tettigoniæ* already described. The locusts constitute a multifarious group of the most voracious and prolific insects which are visible to the naked eye. Some of them are of a large size, others small; some are green, others red or yellow. Among us they receive various denominations, according to their size and colour: When of one form, they are called locusts; those of another, grasshoppers; and a third sort are termed crickets†.

Many of the locusts far exceed the grasshopper tribe in bulk, in rapidity of flight, and the powers of injuring mankind, by swarming upon the productions of the earth. The latter animals are unable to fly any considerable length; and the quantity of vegetable food which a few of them sporting among the grass can destroy, is scarcely perceptible; but when a swarm of locusts, several miles in length, and two or three yards deep, settle upon a field, the consequences are truly alarming. The annals
of

* *Systema Naturæ*.† Barbut's *Genera Insect.* p. 117.

of many countries in the East have recorded their devastations, which at different periods have threatened the extinction of the human race. Happily for the inhabitants of *Europe*, the coldness of their climate, and the humidity of their soil, are unfavourable to their production. In some of the southern kingdoms, their visitations, though far less frequent than formerly, are still an object of terror: In general, however, their incursions are fatal to these animals; they visit us and perish.

The sacred scriptures, which were written in a country where the swarms of locusts made a distinguished feature in the picture of nature, have given us many striking representations of the numbers and rapacity of these insects: They compare, according to the manner of the oriental languages, an army of which the numbers are beyond computation, to a swarm of locusts: They describe them as rising out of the earth, where they were produced; as pursuing a settled march, for the purpose of destroying its fruits; and as co-operating with the divine indignation in punishing the sins of men.

When the locusts take the field, they have, as it is said, a leader at their head, whose flight they observe, and pay a strict attention to all his motions. They appear at a distance as a black cloud, which, as it approaches, gathers upon the horizon, and almost hides the light of day. It often happens that the husbandman sees this imminent calamity pass away without doing him any mischief, and the whole swarm to proceed onward, to settle upon the labours of some less fortunate people: But wretched is the district upon which they alight. They ravage the meadow and the pasture ground, strip the trees of their leaves, and the gardens of every vegetable.

The

The visitation of a few minutes destroys the hopes of a year ; and a famine but too frequently ensues.

In their native tropical climates, the locusts are said not to be so dreadful as in the more southern parts of *Europe*, and the opposite coasts of the *Mediterranean* : There, though the plain and the forest be stripped of their verdure, the power of vegetation is so great, that an interval of three or four days repairs the calamity. But our verdure is the livery of a season, and we must wait till the ensuing spring repair the damage ; besides, in their long flight to this part of the world, they are fatigued by the tediousness of their journey, and are therefore more voracious wherever they happen to settle*.

But it is not by what they devour, that the locusts do so much damage, as by what they destroy ; their very bite is thought to contaminate the plant, and prevents its vegetation : to use the expression of the husbandmen, they burn whatever they touch, and leave the marks of their devastations for two or three years. The bite of many animals operates like a poison to vegetables ; and if this be the case, it does not appear that the depredations of these insects can, in any country, be soon repaired.

Such are the fatal effects of the voracity of the locusts while alive ; and when dead they sometimes prove still more noxious, by infecting the air with a stench that is insupportable. *Orosius* tells us, that in the year of the world 3800, there was an incredible number of these insects which infested *Africa* ; and after having eaten up every thing that was green, they flew off, and were

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drowned

* Goldsmith's Nat. Hist. Vol. 7th p. 345.

drowned in the *African* sea, where they caused such a stench that the putrifying bodies of many thousand men could not have produced effluvia so pestilential.

The eastern borders of the *Russian* empire, are subjected sometimes to the awful visitations of this insect: That which happened in 1690, which extended from *Russia* over a great part of *Poland* and *Lithuania*, was singularly destructive. In some places the locusts were seen lying dead, heaped upon each other four feet deep; in others they covered the surface like a black cloth; the trees were seen bending beneath their weight, and the damage which the inhabitants sustained was beyond computation.

In *Barbary* their numbers are also formidable, and their visits more frequent: During the year 1724, a traveller from *Britain*, remarkable for the accuracy of his observations, witnessed the havoc they committed in that ill fated country *. Towards the end of *March* they began to appear with a southerly wind: During the succeeding months, their numbers continued to increase so prodigiously, that during the heat of the day they rose in swarms so large as to darken the sun. In the middle of *May* they began to retire, for the purpose of depositing their eggs in the drier plains of the interior country.

About the middle of summer the young, already ripe for devastation, made another incursion, in several bodies of a vast extent; although then in the form of worms they crawled forward, climbed the trees, walls and houses, devouring every plant in their way: It was in vain that the inhabitants dug trenches through their fields
and

* Dr. Shaw in his travels through Africa,

and filled them with water; in vain they collected large rows of heath, stubble, and other combustible matter to set them on fire on the approach of the locusts. The trenches were soon filled, and the fires extinguished by the immense swarms that succeeded each other.

The locusts which are thus active in their larva state, remain only about a month in that form; after having completed their growth, they cast that skin which gave them their vermicular shape; and, in order to prepare themselves for this transformation, they attach their hind legs to some twig, where, after some laborious efforts, and several undulating motions, they at last burst the skin: at first, the head only appears, but soon after the rest of the body is disengaged, the whole operation continuing only for seven or eight minutes. After casting their covering they remain for a little in a languishing state, till the air hardens their wings, and the heat of the sun again invigorates them, when they resume their former voracious habits, with an increase both of strength and agility*.

In some parts of the world the inhabitants convert what so generally is considered as a plague, to an advantage, by making the locusts an article of food. It is for this purpose, that in many parts of the east they are caught in small nets, which are constructed for entangling them. When a sufficient quantity is thus procured, they are roasted over the fire in an earthen pan till the wings and legs drop off: when thus prepared they are reckoned tolerable food, and are said to taste like crayfish†.

In *Tonquin* nets are used in dragging a species of them out of the rivers, into which they frequently fall from their

* Dr. Shaw's travels.

† Dampier's voyages.

unwieldiness in the months of *January* and *February*.— This locust, which is reckoned a great delicacy both by the rich and poor, is eaten fresh after being broiled on the coals: It is of the size of the top of the finger, and as long as the first joint; inhabits the low grounds, where it breeds, till the winter season, when it spreads over the country in vast swarms. In all countries where the locust is an article of food, it is regularly brought to market, like shell-fish or small birds in *Europe*. They must have constituted a common food among the *Jews*, since *Moses*, their lawgiver, has condescended to specify the different kinds which they were permitted to eat*.

From participating of this luxury of the *Jews*, however, the inhabitants of *Britain* may deem themselves happy in being excluded. Since the year 1748, none of the destructive species have visited this island: At that period, the great brown locust was seen in several parts of *England*, and many dreadful consequences were apprehended from its appearance. The body of this insect is about three inches long; the antennæ are extended about one third of this length from the head, which is brown. The shield which covers the back is greenish; the upper side of the body is brown, spotted with black, and the under side is purple.

The great *West Indian* locust, of all the animals of this genus, is the most formidable, when individually considered. The body is about the thickness of a goose quill, divided into ten annuli, and is six inches in length: It has two small eyes standing out of the head, like those of crabs

* Vide *Levit.* chap. xi. v. 22. Even these thou mayest eat; the locust after his kind; the bald locust after his kind; the beetle after his kind; and the grasshopper after his kind.

crabs ; and two filiform antennæ. The whole body is studded with small excrescences, which are not much larger than the points of pins : Its shape is roundish, diminishing in circumference towards the tail, which is bifurcated ; between these forks, the animal is armed with a dangerous sting, which invariably wounds any person who touches it. The poisonous matter with which this instrument is loaded, occasions a shivering and palpitation all over the body, which the inhabitants cure by rubbing the wound with palm oil †.

† Goldsmith's Nat. Hist. Vol. VII. p. 348.

SECTION III.

GENUS IV.—*The Fulgora, or Lanthorn-fly.*

THE insects of this genus are rare in *Britain*, only two species being caught in the island. It is the foreign animals of this tribe which have the singular quality of emitting flashes of light when they fly. This phenomenon is thought to be occasioned by the waving of the elytra, whose thinness renders the spots upon them transparent: The effect is probably heightened by some resplendent quality peculiar to the tribe, and by the golden yellow of the under wings bordered with black. However this may be, it is certain that in *China* there is a certain species of the fulgora, which blazes with an amazing lustre, that marks the path of the animal wherever it directs its course, and which in the minds of the timid and superstitious, creates images of danger of the most tremendous kind.

Linnaeus enumerates nine different species, one only of which he has termed *European*, from its residence in that quarter of the globe. They are all characterised by a long projection from the forepart of the head, of a light and empty substance. The antennæ are seated below the eyes, having two articulations, the exterior of which is largest, and of a globular form; the rostrum is bended
inward

inward under the body ; the feet are gressory, or formed for walking *. In these animals the elytra commonly decline along the sides, and when at rest cover the whole of the abdomen ; for they gradually increase in breadth from the base to the extremities.

The fulgura candelaria of *Linnaeus*, is of a fresh green colour ; on the ground of the elytra figured and striated with lines of a pale yellow ; the wings are of a deep and beautiful yellow, with a band of glossy black, bordering their extremities ; the head and thorax are generally of a ruddy brown, and the animal emits flashes of lightning as it flies in the dark.

* *Systema Natura*, Ord. ii. Gen. 4.

GENUS V.—*The Cicada, or Flea locust.*

THE insects of this tribe. obtain sometimes the name of grasshoppers, or froghoppers, as well as the tettigoniæ already mentioned. They are far inferior in size as well as in their destructive powers, being produced from small larvæ that are found on plants resembling the six-legged worm. Some of these larvæ have the singular property of voiding from the anus and the cuticular pores, small bubbles which unite together, and form a species of foam in which the young animal remains enveloped.

This foam, which is not unlike a spittle, is in some parts called the cuckoo-spittle, and is probably intended by nature as a shelter to the larvæ, against the search of other animals to which it would fall a prey: Perhaps, too, this moisture may be designed for screening the insect, in its tender age, from the beams of the sun, and the rough elements by which its body might then be injured*.

Whatever purposes this froth may be intended to serve, it is undoubtedly necessary to the subsistence of the animal†, for it is no sooner wiped away, than a fresh quantity is seen exuding from all parts. During its residence in this spume, the animal acquires four tubercles on its back, in which the wings are inclosed; as soon as these

* Barbut's *Genera Insect.* p. 122.

† De Geer *artes de Stockholm*, 1741. p. 221.

these burst, from a reptile it becomes a winged insect; thus rendered complete in all its parts, it flies to meet its mate, and propagate its kind *.

Other larvæ are unprovided by nature with a frothy covering; their bodies are not so easily injured; and they are enabled to escape from their pursuers by the nimbleness of their running and leaping. The chrysalids and larvæ that produce them differ but little from each other, either in their form or habits: Both run, leap, and climb upon plants; the former distinguished by small knobs upon the back, the rudiments of future wings.

When arrived at their most perfect form, the males of many kinds possess the faculty of singing, by means of an organ situated under the abdomen, furnished with valves and muscles. It is by the help of this sonorous instrument that the male amorously solicits his mate; and from this lively and animated song, the country people preface a fine summer and plentiful harvest †.

The cicadæ have for their generic marks, the rostrum inflected; the antennæ setaceous; the four wings membranous, and the feet formed, for the most part, for leaping ‡. Their heads are generally of a triangular shape; their bodies are oblong; and the wings fastigated, like a roof. The females possess, at the extremity of the abdomen, two large laminae, between which is inclosed a kind of blade, serrated on the edges. This apparatus appears plainly intended for digging holes for the reception of the young, and for sinking them in those plants upon which the larvæ are to feed, after their exclusion from the eggs.

VOL. III.

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The

* Goldsmith's Nat. Hist. Vol. VII. p. 258.

† Barbut ubi supra.

‡ Syst. Nat. Ord. II. Gen. 5.

The genus of cicadæ is divided by *Linnaeus* into five tribes or families, viz. into those whose thorax is compressed, membranous, and larger than the body; those which have their thorax armed on each side with a spine or horn; the third, the manniferæ, whose feet are not formed for leaping; the fourth consists of those whose hind feet are made for that purpose; the last family comprehends those whose wings are wrapped round the body*.

The cicada sanguinolenta of *Linnaeus* is the most beautiful of all our froghoppers: It is of a shining black, both above and below; the elytra have each three large spots of a fine crimson.

* *Systema Nat. ubi supra.*

GENUS VI.—*The Notonecta, or Boat fly.*

THE flies of this genus have the rostrum bent in towards the thorax, the antennæ very short, and the four wings crossed over each other*. The six feet are all formed for swimming; and the abdomen is terminated by four horny appendices. This tribe comprehends in it only three species; the grey, the striated, and the small notonectæ.

The first is of a pale colour, mixed with black, and is very common upon stagnated water†; the head is round, and for the greatest part occupied by two large brown eyes; the antennæ are very small, of a yellow colour, and inserted in the under part of the head; the elytra are of a rusty cloudy colour, large, and crossed one over the other.

The second species also frequents the water, is much smaller than the former, and emits a disagreeable odour. The elytra are pale, striated with a number of undulating transverse lines‡. Its shape is oblong; the forehead and feet of a golden yellow; the thorax brown.

The small notonecta is of a size scarcely perceptible; and, according to the *Swedish* naturalist, has neither wings nor elytra. The whole insect does not appear larger than a small grain of sand, and is of a brown colour, transversely striated§.

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* Regne Animale, p. 100.

† Vide Petivert, Gaz. t. 72.

‡ Fauna Suecica, Ord. II. Gen. 3.

§ Regne Animale, p. 102.

The notonectæ have obtained their name from the singular manner in which they swim on the back, presenting the belly uppermost. This situation seems admirably fitted for the creature's manner of feeding, which is said to be on the under side of plants that grow on the surface of the water; the animal, by having its mouth turned upwards, is capable of taking its food with greater convenience: Nor are its motions in the least impeded by this awkward posture; on the contrary, it is very nimble, diving down instantaneously, when it perceives danger, and rising again to the surface, the two hind legs all the while serving for paddles*.

* Barbut, page 129.

GENUS VII.—*The Nepa, or Water Scorpion.*

THE characteristics of these animals are drawn from their inflected rostrum, the chiliform * antennæ, and the four wings folded crosswise, the anterior part being coriaceous. In the System of Nature there are six species enumerated, three of which are found in *Britain*. All these dwell in the water, both in the state of larva and chrysalids. The eggs of the water scorpion are also deposited in that element; they are of an oblong shape, and have at one extremity two or more vibriscæ, the only part of them which is seen, the rest being sunk and concealed in the stalk of a bulrush, or other water plant. These plants may be removed, and placed in water near the naturalist, who may thus have an opportunity of seeing them hatched and coming forth animated larvæ immediately under his eye. The water scorpions, when thus excluded from the eggs, remain for some time in the state of worms, in the place of their nativity. When they arrive at their full size, and are metamorphosed into complete insects, they are sometimes an inch in length, and nearly half as broad. The antennæ appear in the usual place of the fore legs†; they are armed with a forceps, well adapted to the rapacious purposes to which they are applied. The nepæ are of all animals the most tyrannical;

* i. e. Formed like a hook, or the claws of a crab.

† Vide Geoffroy, as quoted by Barbut, p. 131.

tyrannical; they destroy, like wolves among sheep, twenty times as many as their hunger requires. If one of them is placed in a basin of water with thirty or forty worms of the libellula, each as large as itself, it will destroy them all in a very short space, getting on their backs, and piercing them through the body with its rostrum*.

These animals, though they live upon the water by day, are capable of taking long flights from one pool to another in quest of food: This they are probably often obliged to attempt, from the fierceness of their manners, by which the insects in their vicinity must be soon destroyed. Though so formidable to other creatures, they are nevertheless haunted by a little louse, which probably repays the injuries which the water scorpion so frequently commits upon others.

The cinereous scorpion is the most common insect of this tribe: The head is small, and as it were sunk in a slope of the thorax; the elytra are broad, cross each other, and cover almost the whole abdomen: In the females, the extremity is furnished with two appendices, equal to three fourths of its length.

* Goldsmith's Nat. Hist. Vol. VII. p. 360.

GENUS VIII.—*Cimex*. *The Bug*.

WE are now to examine a tribe of insects equally remarkable for their hideous appearance and their voracious habits. Of this nauseous race *Linnaeus* reckons up no less than an hundred and twenty-one different kinds, all distinguished by these general characters : an insected rostrum ; antennæ longer than the thorax ; wings folded together crosswise ; the forepart of the upper ones coriaceous ; the back is flat, the thorax margined ; and the feet are formed for running *.

For the sake of a clearer arrangement, this numerous genus is distributed into eleven different sections or families ; and among these the *cimex lectuarius* holds the first station. This troublesome inmate has attracted the notice of almost every naturalist † ; and it were well for the rest of mankind, that the knowledge of it had been confined to them. By day, it lurks, like a robber, in the most secret parts of the bed and apartment ; takes advantage of every chink and cranny, to make a secure lodgement, and contrives its habitation with so much art, that scarce any industry can discover its retreat. So cautiously does it avoid the light, that if candles, or a strong fire, be kept burning,

* *Systema Nat.* Ord. II. Gen. 8.

† *Mouffet*, p. 269. *Bonani. Micro.* p. 65. *Rai Inf.* p. 7. *Aldrov. Inf.* p. 534.

burning, it will seldom venture from its hiding place. As soon, however, as darkness promises security, it issues from every crevice, drops from the roof, or crawls from behind the arras; and unhappy is the patient to whom these creatures direct their course. There are some persons whom they do not bite; but such as are selected for their repast are soon covered with wounds, which swell to a considerable bulk, and are often painful. In vain the sufferer endeavours to relieve himself, or avenge his wrongs, by killing some or driving others away: famished multitudes renew the attack, and occupy their place; while, in the meantime, the bed becomes insupportable by their nauseous smell; nothing remains for him, but to make a timely retreat, otherwise he will be disfigured and swollen with their wounds, and spend in restless agitation those hours in which the weary are destined to rest, and even the wretched to forget their sorrows.

The retreats of the house bug, in its wild state in the fields, are unknown: About a century ago, it was scarcely seen in *Britain*; and happy for the inhabitants, it multiplies less in this country than almost any part of the continent. Throughout *France*, *Italy*, and *Spain*, the beds in most of the inns swarm with bugs; and every piece of furniture seems to afford them a retreat. They acquire a greater size in proportion as the climate is warmer; they are more active, and bite with a more cruel appetite. There the weary traveller, who is subject to be bitten, remains the whole night like a sentinel upon duty; and, instead of inviting the approaches of sleep, watches the attacks of innumerable invaders, who are ready to gorge themselves with his blood*.

* Goldsmith's Nat. Hist. Vol. VII. p. 282.

The house bug differs from all the rest of the genus, in having neither wings nor elytra. It has two small brown eyes, and two antennæ, having each three articulations: Underneath these lies the crooked trunk, its instrument of torture, which, when the animal is in motion, lies inflected upon the breast. The parts of generation are obvious in both sexes: they are often seen coupling together in the act of procreation; two days after which, the female deposits her eggs, to the number of an hundred and fifty.

Cleanliness is the best antidote against these animals, as their hostile attacks appear the proper punishment of its neglect. Many secret compositions are made use of to destroy them; but that object seems rather the effect of assiduity than of a cure. Mixtures have been made for this purpose, of soap, verdigrise, and *Scotch* snuff, which are said to be effectual. After having taken down the bed three or four different times, and washing it with a solution of corrosive sublimate, they have been banished. The smoke of peat, where that fuel is to be had, is the most efficacious of all applications, and uniformly destroys these troublesome animals wherever it is applied.

The field bugs have all wings, and inhabit plants as various as their shape and colour. In their larva state they are very active, and differ but little from the perfect animal, except in their wanting wings: In this state, however, as well as that of a chrysalid, the animal is incapable of propagating its kind. After the last transformation, the wings unfold; and the impregnated female lays her eggs commonly ranged one beside another, upon the leaf of a plant.

These eggs, when viewed with a microscope, present singular varieties of configuration: Some are crowned with a row of small hairs; others wear a circular fillet; and the greater number have a cappice, which the larva pushes off when it bursts open the egg. Released by nature from their prisons, the young overspread those plants upon which they feed, extracting, by means of the rostrum, those juices which are proper for their nourishment. Even in this state, the larvæ begin to renounce their graminivorous and peaceable habits; some of them are voracious in an eminent degree, and spare no small animal that comes in their way*.

This seems indeed but a prelude to that ferocity which these creatures display in their perfect state: Then they destroy caterpillars, flies, and many of the coleopterous insects, which seem protected from their assaults by the hardness of their wings: They are then mere cannibals, who glut themselves with the blood of every animal, not excepting even those of their own genus.

The cimex hiosciami of *Linnaeus*, or hen-bane bug, from its residence on the plant that bears that name, is described by *Ray* under the appellation of the smaller wood bug. Its body is of an oblong and narrow shape: Above, the insect is red, variegated with black spots†.

Another species is also found on the hen-bane, with brown wings, decorated with white spots; it is described by *Linnaeus* in the *Fauna Svecica*‡, and is twice the
size

* Barbut's Gen. Insect, Ord. II. Gen. 8.

† Rai Insect. p. 55.

‡ And his Voyage to Oelande, p. 155.

size of the former, but resembles it nearly in shape, and the distribution of its colours. Of the various races of bugs, some are found in the meadows ; some frequent flowers ; and a great many reside among bushes and thrubs, which seem almost to defy the pencil to discriminate them, or imitate their various hues.

GENUS IX.—*Aphis*. *The Plant Louse*.

FEW insects are more common than these, while few present greater singularities to the observation of the naturalist. Plant lice are seen on the leaves of a great variety of plants, and often in society, and in considerable numbers. At certain seasons, they are viviparous, and at others they produce inanimated eggs, which remain in that state till the action of the sun call forth their vital powers. The fetus, when the parent is viviparous, shews signs of life before it is fairly excluded from the body. Sometimes the same mother gives birth to near twenty in a day, without appearing less in bulk than before *. If one of these pregnant females are taken and pressed between the finger and the thumb, a still greater number of young will be forced from her body, one following another like a string of beads, and growing smaller and smaller, in proportion as their period of natural delivery was more remote.

Reaumur is of opinion that fecundation is performed among the females of this tribe, without copulating with the male †; and the experiments of succeeding naturalists have confirmed an assertion that seems to be contradicted by the analogy of all animated nature. Take a plant louse, the instant it issues from its mother; shut it up carefully from all access to congenerous animals; and if
it

* Reaumur, Tom. III. p. 291.

† Memoir. pour servir a L'Hist des Insectes, Tom. III. mem. 2.

It prove a female, it will produce young : In like manner, the young produced from this virgin louse, kept separately, will produce an offspring. Some naturalists have repeated this experiment to the third and fourth reproduction. *Bonnet* observed nine successive generations of this nature, all in the space of three months. The most probable account of this singular fact seems to be this ; that as in all animals fecundation is accomplished by the copulation of male and female ; so that happens with the plant lice ; but with this difference, that the fecundation produced by that act is transmitted for several generations, before the prolific virtue becomes entirely exhausted.

The young, immediately after being protruded from the mother, are always of a paler colour than the parent : They have then the entire use of their limbs, and go in quest of food. All the different kinds cast their skin ; and it is after these developments that such of them as have wings obtain these parts.

It is not the males only that are winged, as we have seen in some other genera ; many of the plant lice of both sexes are deprived of these instruments in their most perfect state ; for many of the females without them are seen producing young. As the larvæ of these insects possess all the activity peculiar to their genus in its last stage of growth, so they are equally distinguished by voracity. They are furnished with a small trunk, which pierces the leaves, and enables the animal to extract the juices proper for its nourishment. Many plants grow deformed by the number of punctures thus made upon their leaves, and decay from the want of their usual sap. Some thrive even when covered with these insects, while others rise up into small hollow tubercles, which, on being

being broken open, disclose the numberless families that inhabit them †.

These galls or excrescences formed by the plant louse, and which often so much disfigure the shrubs upon which they grow, are in *China*, *Persia*, and the *Levant*, applied successfully in dying. Some species formed in these more northerly climes might probably be turned to the same useful purpose, were their virtues understood.

The plant lice are seen to void from the anus a clear liquid substance, of a saccharine nature, which is greedily sought after by other insects; the same kind of sugary liquid oozes from the extremities of two small horny appendices that terminate the abdomen. It is in pursuit of this fluid that the ants are seen to frequent those plants upon which the plant lice settle in greatest plenty. From this circumstance, the former animals have been supposed hostile to the latter; while other naturalists have deemed it an indication of the friendship of the two genera for each other: but it is neither from motives of love nor of hatred that the ants repair in such numbers to these haunts; they seek to gratify their avidity, by devouring their excrements.

The most effectual method of preventing the depredations of plant lice upon flowers and the leaves of plants, is suggested by those insects which live by preying upon them. The plant louse-lion, or aphidivorous fly, either by instinct or foresight, deposits her eggs in the midst of these animals; and as soon as the larvæ are produced, they devour hundreds around them, without the necessity of any other movement than turning to the right side or the left. This formidable insect is furnished with two
tubercular

† Reaumur ubi supra.

tubercular horns, with which it pierces the plant louse, and sucks its juice. A number of its eggs placed upon the leaves frequented by the lice, would soon produce a number sufficient to suppress or destroy them*.

The plant louse is a very minute insect. Its generic characters have been thus described by naturalists: The rostrum is bent inwards; the antennæ are longer than the thorax; there are four erect wings belonging to many genera, while others altogether want these parts; from the extremity of the abdomen there project two horny appendices; the feet have one articulation, and are formed for walking†.

M. de Reaumur supposes that almost every plant has its peculiar louse, the colour varying according to that of the leaves upon which they reside. Thirty-three species are reckoned up by the *Swedish* naturalist.

* *Reaumur*, Tome III. Memoire xi.

† *Syst. Nat. Ord. II. Gen. 3.*

GENUS X.—*Chermes*.

NEARLY allied to the last tribe of insects, but of superior size, is the chermes, a race termed *gall insects* by *M. de Reaumur* *. Their characters are drawn from the situation of the rostrum, which is placed in the breast; and from the shape of the antennæ, which are longer than the thorax. The wings are four in number, folding close along the sides of the abdomen; the feet are formed for leaping, their tarsi having two articulations.

These animals are found inhabiting a great variety of different trees and plants, upon which they produce very singular excrescences: The *Linnaean* names affixed to each species are for the most part derived from the particular tree upon which they feed; that of the fig tree is the largest, and therefore more easily examined than any of the rest of the tribe.

The whole body of this insect is brown above, and green beneath; the antennæ are large, hairy, and of the same hue with the back. The wings, which are twice the length of the abdomen, are placed so as to form a kind of roof, as if to protect the animal from rain †. Other species, of inferior size, frequent the elm, the ash, the cherry, and the fir; that which inhabits the last of these trees is provided with a sharp pointed instrument,
by

* Tome III. Memoire x.

† Barbut's Gen. Insect. p. 150.

by which it makes punctures in the extremity of the branches, in order to deposit its young. By this means the fir-tree chermes produces that enormous scaly protuberance, which is often seen at the summit of the branches, and which is formed by the extravasation of the juices through the wounds thus made †.

The larva chermes has six feet: In figure, it resembles the perfect insect; its shape is oblong, and its motion slow. In the chrysalid state, the form is somewhat changed, by two small protuberances upon the thorax, the rudiments of future wings. When the chrysalids are about to undergo their last metamorphoses, they retreat to the under side of a leaf, to which they remain attached without motion.

On the approach of their change, the membrane above the head and thorax is seen to split and open: The perfect insect then comes forth with its wings, leaving the spoils of its chrysalis still adhering to the leaf, and rent on the anterior part. The empty sloughs of these insects are often found in great plenty beneath the leaves of the fig-tree.

The tubercles raised upon the branches of trees by the punctures of the chermes, not only become the residence of the animal, but also of its eggs and larva, which are contained in those cells with which they abound. The box-tree chermes produces no excrescences upon that plant: Its punctures make the leaves bend in towards each other at their extremity, where their union forms, at the summit of the branch, a hollow knob, in which the larvæ of that insect find shelter.

† Vide Reaumur & Frisch. Germ, xii. p. 10.

Both in their larva and chrysalid state, many of the chermes eject from the anus a white saccharine substance resembling manna: within the hollow balls formed by the box leaves, there are small soft grains of this substance deposited; and in that state it is frequently seen issuing from the anus of the insect that dwells there †.

† Barbut's Gen. Insect. p. 152.

GENUS II.—*Coccus*. *The Cochineal*.

THE insects of this tribe, present the most singular form which we have, perhaps, yet surveyed in this department of animated nature. They were long imported into *Europe* as an article of commerce, before their claim to rank among animals was admitted.

The males are commonly of a smaller size than the females; the former have two erect wings, while the latter are apterous; the rostrum is situated in the breast; the antennæ are fetaceous, and the poisers or halters are wanting; the posterior part of the abdomen is bristly, or velvety*.

Several species of these insects are found upon *European* plants; that, however, upon the pimpinella roots, called the grain of scarlet of *Poland*, was long known in this part of the world, as a dye, before the *Mexican cochineal* was introduced. A particular history of this insect, which is now no longer an article of commerce, since the discovery of *Mexico*, may be found in *Breynius*, as quoted by *Reaumur*†.

The drug at present most in estimation, for the fine colour it gives our clothes, is the cochineal of *Mexico*; an insect domesticated and reared with great care by the *Indians*. It grows not upon the root, but upon the

3 K 2

leaves

* *Systema Naturæ*, Ord. II. Gen. 2.† *Tom. IV. p. 155.*

leaves of a plant known by the various names of opuntia, nopal, racket, and cardassia. The method of cultivating them upon this tree, practised by the *Mexicans*, is by collecting ten or twelve together into one nidus, made of moss or cotton; these insects being put into these nests, are fixed to the branches of opuntia, which is planted around their houses.

Cochineals have not long remained in this state when they produce swarms of young, which disperse and feed among the juicy leaves, and there produce a new generation. The insects having thus multiplied, are gathered three different seasons in the year: the first is performed by taking away the nests that were placed originally upon the tree; the second, by picking the cochineal from the leaves with pincers; and the third, at the approach of winter, by cutting off the leaves, which are yet loaded with insects: This last contains animals in various stages of their existence, and of different sizes; it is, therefore reckoned of inferior quality on that account, and also, because, in scraping the leaf, some part of the epiderm necessarily comes off, and mixes with the cochineal. The *Spaniards* call it *Granilla*.

Having thus collected the insects, the next part of the process is killing them and preparing them for sale; and according as this is performed, the cochineal is supposed to be of different quality, and obtains various names, according as its colour is supposed to be more or less affected. That which is prepared by the gentle heat of ovens, is of an ash-grey, or mottled colour, and named *Y-sprada*. If the insects are deprived of life by plunging them with baskets into hot water, it then goes by the name of *Renegrada*, and is not covered over with that white powder, common to the other kinds. Lastly, it
 bears

bears the appellation of *Negra*, if destroyed upon the hot plates that have been used for the roasting of maize.

But whatever be the method of preparation, that cochineal is always found superior, both in quality and quantity, which has been produced upon the cultivated trees. The cultivation of the *opuntia*, therefore, and the raising cochineal, is a trade almost universal throughout *Mexico*: Eight hundred and eighty thousand pound weight of this article, is said to be annually imported into *Europe*, where it sells at a high price*. Various are the uses to which our luxuries, and the arts subservient to them, have applied this drug. It is used in dyeing, and produces along with other substances, a variety of shades of scarlet: It furnishes painters with many lively shades of scarlet, crimson, and red: When ground into powder, it enters copiously into that carminative mixture which imitates the bloom of youth on the human cheek, and which is so frequently had recourse to by the fair, who would repair the injuries of time†: had it really this effect, the *Mexicans*, we must allow, would command a treasure of greater value than all the mines of the new world.

Some attempts have been made by the *French* to find out the cochineal in *St. Domingo*, and to rival the *Spaniards* in their lucrative commerce in that article. The specimens, however, that have been produced in *Europe*, by one of the correspondents of the academy of sciences‡ in that island, have not, hitherto, answered expectation, but produced a colour so weak as gives reason to doubt whether the insect be of the same species. It is probable;

* Reaumur, Tom. IV. p. 106.

† Barbut, page 156.

‡ M. du Hamel, Doctor of Medicine.

ble, however, that the art of transporting the cochineal; like the silk worms, into whatever country the opuntia may grow, will soon be discovered, and the monopoly of that drug be no longer engrossed by the *Spaniards* *.

* Reaumur Tom. IV. p. 109.

GENUS XII.—*Thrips*.

IN this race of insects the rostrum is so obscure, from its minuteness, as to be scarce perceptible: The antennæ are filiform and as long as the thorax; the body is of equal thickness through the whole length, and slender; the four wings are extended along the back, narrow in proportion to their length, and crossed at some distance from the base; the abdomen is bent upwards, and the feet commonly have two articulations. Only five species are enumerated under this genus by *Linnaeus* *.

The animals of this family are so minute, that they are not objects of discussion, unless viewed with a microscope; to the naked eye they appear rather like atoms than living animals. They reside commonly upon flowers, and under the bark of trees, and it is there also that their larvæ are found, which only differ from them by their wanting wings and elytra. The thrips *jurisperrina*, is one of the largest of this diminutive race; the thorax and abdomen are black, the elytra white. In autumn it is found in numbers among flowers, and on the juniper. *Linnaeus*, for a long time, was uncertain how to arrange it, from not discovering more than one pair of wings †. *M. de Geer* first observed that it had four exceedingly narrow ones, with which it flies but little, but runs quickly ‡.

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* *Systema Naturæ*. Ord. II. Gen. 12.

† *Fauna Swec.*

‡ *Actes de Stockholm*, p. 3. 1744.

CHAPTER IV.

SECTION I.

ORDER III.—*Lepidopterous Insects.*

THIS order contains all the different kinds of the moth and butterfly; insects characterised by four wings, which are imbricated with scales; and by a mouth furnished with a spinal tongue, which can be extended or rolled up at pleasure. The bodies of all this class are covered with down, and their wings decorated with such a variety of brilliant colours, that they may be regarded as the most beautiful with which nature has enlivened and adorned the fields.

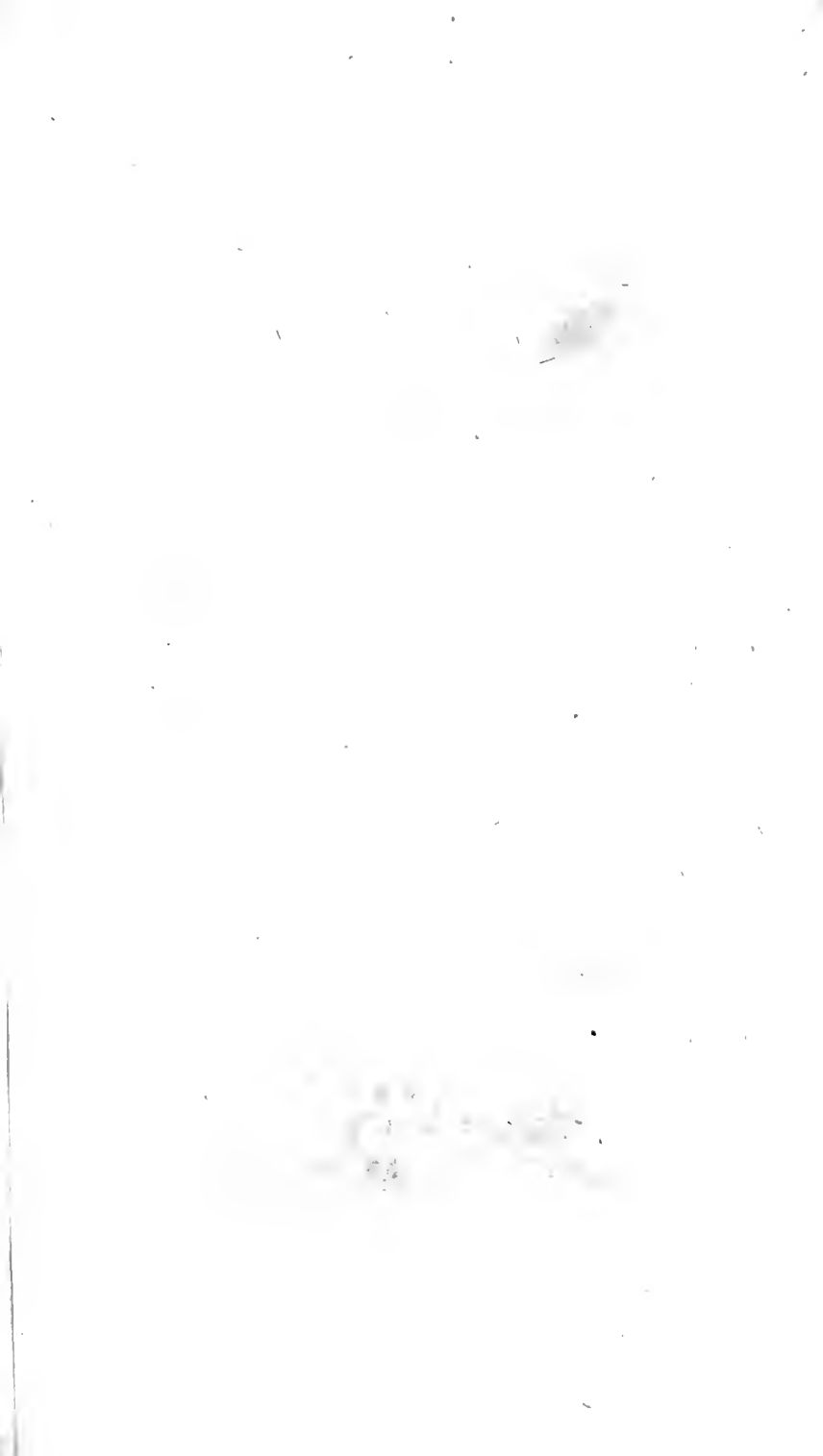
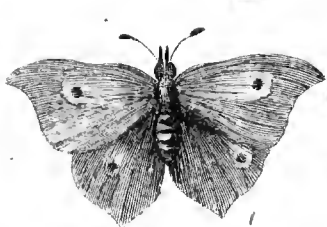
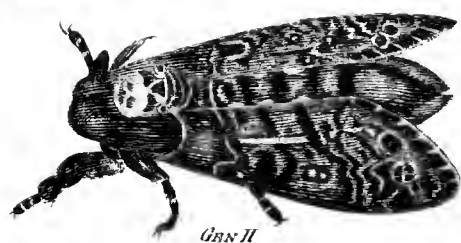


Plate VI.
ORDER III



GEN. I
PAPITIONES



GEN II
SPHINX

GENUS I.—*Papilio, the Butterfly.*

THE antennæ of this genus grow thicker, and are generally terminated with a knob or capitulum. When fitting, the wings are not folded down, but erected so that their extremities nearly touch each other above the body. They are distinguished from the moths, by flying in the day time.

Of this genus there are 273 different species, already known and described: To prevent confusion, they have been arranged by *Linnaeus* into five distinct classes, viz. the equites, the heliconii, the danai, the nymphales and the plebeii*. Each of these classes is characterized by some particular part; so that every species when examined, discovers immediately to what class it ought to be referred.

There is no class of insects which hath been more accurately examined, or whose history hath been so fully detailed, as that of the butterfly and moth. Two large volumes have been dedicated solely to this tribe by the indefatigable *Reaumur*. The metamorphosis of insects is better illustrated by their history, because in them these changes are more frequent, and more perceptible.

Some of these animals frequently cast their skin, besides undergoing those more considerable transformations which introduce them into a new sphere of action; be-

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fore

* *Systema Natura*, Ord. III. Gen. 4.

fore these develope, the outer skin is seen to wither and lose the vivacity of its colours, owing to a new coat which already covers the animal beneath, and intercepts the juices which formerly circulated through it: After some efforts, this dried covering is rent towards the back part of the head, where a fresh skin appears; and through this aperture, the worm makes his escape leaving his spoils behind*.

After undergoing several changes of this kind, the animal prepares to undergo another still more considerable, which is to introduce it into the state of a chrysalid, deprived of almost all motion, and incapable of taking food. This change is effected nearly in the same manner as the foregoing; but in some it is very long in being accomplished. Several species of the butterfly worm, construct in a very ingenious manner a coque or nut of silk, into which they enter before their transformation, and in which they continue for nine months, without food, before their metamorphoses be accomplished†. During this long period, they are apparently inanimate, and take no food.

Various substances enter into the composition of the habitations constructed by these animals before their metamorphoses; some are of silk; in others that is combined with other matter; several kinds construct no habitation, but are protected by a crustaceous shell, formed by a glutinous substance, exuding from their bodies: Some are suspended vertically, while others hang horizontally by a thread which surrounds the middle of the body‡.

The external form of the chrysalids varies according to the species of butterfly that inhabits them; in all, however, there are apertures opposite to the thorax, by which

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respiration

* Reaumur, Tome I. mem. 3.

† Tome II. mem. 1.

‡ Idem Tome I. mem. 11 & 12.

respiration is carried on during the whole period of their inactive state. After the appointed time, when the animal has acquired sufficient vigour, the shell is broken, which at once constituted the grave of the caterpillar; and the cradle of the butterfly: the down already grown upon the insect has completely separated it on all sides from the shell, which, by the action of the head, is broken opposite to that part, and affords free egress to the prisoner it so long confined*.

The wings of the butterfly, on its first appearance, are closely folded; but by the help of a liquor constantly circulating through them, they are soon expanded, and sufficiently hardened, by the action of the air, to endure the efforts of flying. It is then that the insect enters upon a more enlarged sphere of action, with increased powers: He ranges from flower to flower, darting his rostrum into their nectaria for the delicious stores they contain. Then too in the full possession of every faculty granted to his race, he prepares to multiply and perpetuate it.

This last and most considerable metamorphosis, is attended with a greater change in the economy of the animal, than any of the preceding; not only the skin, but the teeth, jaws, and *cranium*, are left behind. The large artery which passes along the body, may be considered as a succession of different hearts employed in circulating the blood, which is at that important æra, observed to flow in a different direction from what it did before, like the fœtus of a quadruped after birth†: Formerly it circulated from the extremity to the head; it now pursues a course directly opposite.

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* Idem, mem. 14.

† Vide Malpighi and Reaumur. Tome I. mem. 19.

The quantity of food taken by these animals in their last state, is comparatively small to what they formerly devoured. For a short time after their appearance on the wing, their excrements are voided in a greater quantity, and red like blood; this is, perhaps, the remains of that food, which they contained before their last change. Its appearance on the surface of the earth, has at different times been regarded as portentous of some heavy calamity, being supposed to be blood that had dropt from the clouds*.

Some of these animals are gregarious, and live in society during every stage of their existence; others live in that state during one period of their lives only. The duration of their life is various according to the weather; its warmth accelerates every step of their progress, and cold retards all their developements: A worm produced in a certain period of the summer lives only for three months, while the same species, if hatched a little later in the season, lives another year; hence, *Reaumur*, has devised a method of prolonging the lives of these animals greatly beyond their natural course.†.

The butterflies of every species are extremely prolific; a single female at one birth produces several hundred eggs: and the most wonderful particular in the history of these insects, is the precautions by which they provide for the security of the young; some tear off the down from their own bodies to supply them with a covering‡.

Various

* Vie de M. Pierese par M. Gassendi.

† Tom. II. mem. I.

‡ Reaumur, Tome II. mem. 2.

Various insects prey upon the butterfly, or hasten the approach of its dissolution. A certain species of fly makes its way into its body, while yet a worm, and there deposits its eggs, and, although this worm continues to live, and be metamorphosed into a chrysalid, no butterfly is produced from it, those internal parts that were essential to its preservation, being consumed by the larvæ of the fly. From the great fecundity and variety of the insects of this genus, they probably would soon cover the surface of the earth, did not nature provide a bar to their increase, by multiplying their enemies: hence they are destined to become the food of a great number of animals of various kinds, some of which swallow them entirely, others macerate their bodies; while many accomplish their destruction by gradually sucking their juices. A single pair of sparrows, in order to supply themselves and their young, may destroy, as is supposed, three thousand, three hundred and sixty butterflies in one week †.

The vast number of animals belonging to this genus, and the variety and richness of their colouring, afford ample scope to the painter for the exercise of his art. It was chiefly of these insects that *Madame Mariamne* exhibited those exquisite drawings that constitute the peculiar merit of her work. It is principally in *America*, the *East Indies*, and *China*, that those species are found, which constitute the ornament of our collections. From the policy of the latter country, the ladies are circumscribed in their amusements; there they domesti-

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cate

† Vide a General Treatise on Husbandry, &c. by Mr Bradely, Professor of Botany in Cambridge, 1724.

ate various species of this tribe of insects, and make their economy and manners the principal study of their lives ; large glass apartments, furnished with proper food, being fitted up for the accommodation of these animals.

GENUS II.—*Sphinx*.

THIS tribe contains all those insects which hold an intermediate station, between the butterflies and moths. Their antennæ are of a prismatic form, thicker in the middle than at the extremity ; their wings fold down over the back when at rest ; when on the wing their motions are slow and heavy. The moths, or phalænæ are nocturnal insects. The butterfly makes its appearance in the open day ; while the excursions of the sphinx are chiefly in the twilight of morning and evening *.

The insects belonging to this genus, though far less numerous in their varieties, present not uniformly the same characters to the observer ; some have angulated wings ; in others, the wings are entire ; some are known by a barb, or tuft of hair growing from the anus ; while many are distinguished by other differences in their external appearance, both in the larvæ and winged state. These last, *Linnaeus* has termed *adscitæ*, as if brought into the family by a sort of adoption, and thus distinguished from the legitimate sphinxes.

The name of sphinx has been given to the insects of this genus from the singular attitude in which they are often seen in their caterpillar state ; the hinder part of the body is then seen attached to the branch of a tree,
while

* *Systema Naturæ*, Ord. III. gen 2.

while the rest of the body like the celebrated sphinx stands in an erect posture: The cod which they form, previous to their metamorphosis, and into which the animal enters, is constructed below ground of earth and grains of corn, interwoven with threads of their own manufacture: When invested with the powers of a winged insect, their voracity is diminished; they fly heavily from flower to flower, introducing the tongue into the nectaria for the liquor contained there.

The sphinx atropos is the most remarkable animal of this genus; the upper wings are of a blackish brown, waved irregularly above and below, with bands of a lighter hue; the under wings and abdomen, are of a fine yellow, variegated with transverse bands of black*. The worm from which this insect proceeds is large, smooth, and green, terminating in a kind of horn at the extremity†.

The most remarkable part of this animal is the representation of a *death's head*, which is seen upon the upper part of the thorax: This mournful picture is formed by a large irregular gray patch, marked with two black dots near the middle‡. In the province of *Brittany* the people were afflicted during a certain season with an epidemic disorder, which often proved mortal; the inhabitants were greatly alarmed by the unusual numbers of these insects, which the common people imagined came to forebode their destruction, by this portentous representation upon their backs. The Royal Academy was consulted, whether the sphinx, by its uncommon numbers, might not be the cause of this calamity, so great was the alarm which their appearance created§.

* Fauna Swecica n. 809.

† Rai Insect. p. 362. n. 62.

‡ Reaumur, Tom. I. p. 293.

§ Idem, ubi supra.

The sphinx atropos, when hurt, has the power of uttering a dismal and melancholy cry, like a mouse; owing, as is supposed, to the violent rubbing of some of its scaly members. There are forty-seven different kinds of these animals.

GENUS III.—*Phalænæ*. *The Moths*.

THE moths are the most numerous genus hitherto known, either in the animal or vegetable world: *Linnaeus* has enumerated about four hundred and sixty species, and probably is far short of the real number. They are more frequent in warm and dry climates than in ours; and they are more plentiful in *South* than *North Britain*. In the former country, seventy different kinds have been collected; while in the latter, scarcely half that number have yet been noticed. The characters by which this numerous genus is distinguished are the following: The antennæ setaceous, diminishing in thickness from the base to the extremity; their wings, when at rest, are in general folded down; and they fly during the night. The race of moths have been further subdivided into eight different families. The first, called the attaci, have the wings hanging downwards, and spread open; and the antennæ are either pectinated or setaceous: The second are named bombices, and have their wings covering the body horizontally, with pectinated and setaceous antennæ: The third family comprehends the noctuæ, whose wings are incumbent, and the antennæ setaceous: Those of the fourth tribe are termed geometræ, and have their wings, when at rest, extended horizontally: The tortices are distinguished by obscure wings, the exterior margins forming a curve: The pyralides have the inner margins of the wings laid one over the other: In the tincæ, the wings

wings are wrapped up, and folded round the body, so as to give the insect a cylindrical form : And, lastly, the family of alucitæ have their wings split, or divided into different branches, almost to their base *.

The greater part of these phalanæ, or moths, when at liberty in the fields, only fly during the night, or towards the evening : Those which are domesticated in boxes made for that purpose, give indications by their fluttering within when the natural period of their activity approaches. During the day they remain quiet, and apparently reconciled to their confinement; they flutter throughout the whole extent of their prisons, and testify their impatience at their want of freedom.

All the diurnal butterflies are provided with a rostrum for gathering, and for the reception of their food ; a great part of the phalanæ are entirely destitute of that organ, while in others it is so small as scarcely to be discernible with the naked eye. This singular fact hath been fully investigated by the indefatigable *Reaumur*, who, after examining many moths with a strong magnifier, has not been able to discover the smallest vestige of a mouth †. A considerable number, therefore, of these animals, must pass the whole of their winged state without food : These cannot be destructive to cloth or furs, except while they remain in the form of worms.

The caterpillars from which the various species of moths are produced, exhibit nearly the same variety of appearance as the winged insects which spring from them. Some are large, while others are extremely minute; many are provided with ten, others twelve and fourteen feet; the largest and most common have sixteen. Some

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of

* Vide Syst. Nat. Ord. III. Gen. 3. † Tom. I. Mem. vii. p. 286.

of the smaller caterpillars are smooth, and others covered with hairs, which produce an itchiness and an inflammation, when they touch the human skin *.

All the caterpillars of phalænæ, after having several times cast their skin, spin for themselves materials of a habitation, in which they are to be transformed into chrysalids. Of all the inventions of insects to protect themselves during their state of imbecility, that practised by the silk worm is most universally known; and if animals acquire a consequence or reputation from their connection with man, and the conveniencies with which they accommodate him, this insect may challenge, perhaps, a larger share of it than any other animal whatever. Our luxury has brought silk into such general request, that it now may be deemed a necessary of life: The poor, in some countries at least, would find it almost impossible to procure the necessary articles of clothing, were woollen stuffs worn by all those who at present are supplied with silk.

The produce of the common silk worm has been found most proper for the purpose of manufacturing into cloth: That glutinous substance with which the silk is always covered when it first comes from the worm, and which gives it that adhesive quality so proper for constructing their edifices, sooner dries than in that of any other insect. The cods constructed by some other species are so firmly glued together, that no operation can separate the threads. The produce of many is by far too fine for any purpose in our manufactures, while that of another class is too coarse.

Several

* Idem, Tom. I.

Several very laudable attempts have been made, but hitherto without any considerable degree of success, to rear the silk worm in *Britain*. The public have lately been informed by a manufacturer in *Paisley*, of his having prepared a web entirely of the silk produced by worms of his own rearing *: And in the transactions of the society for the encouragement of arts, manufactures, and commerce, a number of very useful experiments are recorded with regard to the food and management of these insects †.

Probably the want of a sufficient number of mulberry trees has hitherto rendered ineffectual the efforts of our countrymen to introduce and rear any considerable quantity of silk worms. From the attempts that have already been made, it appears that the white mulberry is preferable to the black in feeding, and that the latter is to be preferred to the lettuce. Twelve cocoons, the produce of worms fed upon the white mulberry, weighed seven penny weights two grains; while an equal number of those that had been fed upon the black mulberry weighed only six penny weight three grains: Six penny weights were obtained from the same number of worms fed upon common lettuce ‡.

Endeavours to produce raw silk in *Britain* seems the more worthy of encouragement, as that country appears to possess some advantages of which *Italy* and many of the silk countries are deprived. In *Italy*, the chrysalids soon come to life; and it is there necessary to destroy them, lest, by eating their way out, they should injure the silk. In order to effect this, they are collected and placed

* Vide Glasgow Newspapers, November 1791.

† The Rev. M. Swayne's Letters to Mr. More, Vol. VII.

‡ Transact. ubi supra.

placed in heated ovens, where the silk, without singular caution, is apt to be damaged. In our climate, where every progression of the insect tribe is slower, there is sufficient time to wind off the silk without killing the chrysalis.

But beside the injury that may be done to the silk in *Italy*, from the length of time which it is necessary to keep the chrysalis in these ovens, they are there obliged to suffer the moth to eat its way out of the largest cones, in order to have eggs from the most vigorous and healthy. Hence, they lose all the silk of these cones; whereas, in this country, the silk may be gathered while the moths are preserved. Thus, we seem to possess two striking advantages, which may probably compensate for the want of others which our climate has denied us.

Even the climate, however, of *England* is in some respects superior to those where silk is raised. In the south of *France*, the frosts are often so intense as to kill the mulberry leaves after they are out. At that season of the year, this is seldom the case in *South Britain*; which is also more free from lightning, and those sultry heats that have always been deemed prejudicial to the silk worm. From these considerations, the time may probably arrive, when our countrymen, by farther knowledge and experience upon this subject, may be enabled to avail themselves of these advantages, and become entitled to a rank as distinguished among the raisers, as that which they have long held among the manufacturers of silk.

The silk worm, however, is perhaps far from being the only insect of whose labours man might avail himself. There are many species very common, and immensely fertile, that might be beneficially employed in procuring
silk;

silk, did we know how to avail ourselves of their labours. *M. de Reaumur* has mentioned several whose productions ought to be subjected to experiment by the manufacturer; and in some future period, some of these may be turned to account *.

Of many of the caterpillars belonging to this class of insects, the silk, it must be allowed, is altogether unfit for our purposes: their coques are not only coarse, but so scantily provided with silk, that the animal is obliged to join dry leaves, bits of wood, and other materials, in order to give stability to its edifice: Farther, many of them spin under ground, and their work consists only of joining and connecting together, by means of their threads, different particles of earth, of which their house is composed. These caterpillars, when kept by the naturalist, who waits for their phalænæ, must be supplied with earth in the boxes in which they are lodged; otherwise they will perish, from not being able to construct an edifice fit for their reception †.

The phalænæ, in their chrysalid state, differ from the butterflies, in remaining for a much longer period before their metamorphoses into perfect insects is completed. Their form, too, is then different, being oblong, and not angular, like the chrysalid of the butterfly. Some remain in their coques for several years successively; especially if a cold damp situation has retarded their progress. So great is the effect of heat in precipitating their developments, that a moth in a warm exposure may be produced from its chrysalid, even in the depth of winter.

After the phalænæ issue from their last covering, some of them are destitute of wings: These are the females of certain

* Tome I. Mem. vi.

† Barbut's Gen. Insect. p. 189.

certain kinds, who, instead of wings, have only short protuberances. altogether unfit for the purpose of flying. They have the appearance of large creeping animals of a different order, and can only be recognised for moths, by the shape of their antennæ, which are similar to those of the males, and by those scales with which the body of these animals is covered.

The phalænæ, though less brilliant in colour than the butterflies, are some of them far superior in size. The pavonia major of *Linnaeus* is much larger than any species of the butterfly yet known: In bulk, it seems rather to resemble a bird than an insect; and in the richness of its clothing few of the feathered race can vie with it.

The three pavoniæ * have their name from those rich and brilliant colours which are supposed to have some resemblance to the gaudy dress of the peacock. Their wings appear covered with a glossy fur; and when spread, display four eyes, decorated with vivid colours. Their caterpillar is also very beautiful; it is covered with hair, and it is the property of such to produce those scaly phalænæ, which are most distinguished by the brilliancy of their colours.

The moths in general do not fly by day; yet in the summer evenings it is the light which attracts them into the dwellings of man: Then they are seen entering the rooms, and fluttering around the candles, where they often meet with a painful death. This fondness for light has suggested to the curious a method of catching these animals, by carrying a lanthorn into a bower, around which they all flock, and numbers are led into captivity.

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* Syst. Nat. Ord. III. Gen. iii. sp. 7.

The phalæna of the silk worm, *bombyx moris*, frequents the leaves of the mulberry, upon which it is universally known to feed. It is one of those insects that has deservedly attracted the notice of almost every naturalist; and to a particular description of it we direct the reader in the note below*.

The most beautiful of the *English* insects are the following phalænae, viz. the large emerald, or *geometra papilionaria* of *Linnaeus*†. The thorax, wings and abdomen, are of a lovely pea-green; the wings are decorated with small indented bars, and margined with a fringe of golden yellow.

The peach blossom: The head and thorax of this insect are dark brown; the superior wings are of the same colour; but each is ornamented with five spots, of a pale pink, or rose colour, and appear very like small roses painted on the wings: The abdomen and inferior wings are of a fine pale brown colour: The caterpillar feeds on raspberry leaves; changes into a chrysalis in *June*, and in *July* comes forth a moth‡.

The phalæna which in its larva state is destructive to woollen cloth, is of a narrow oblong shape, having the wings raised towards the extremities: The head of this insect is white; the superior wings black towards the base, and white as they approach the tips: The inferior

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wings

* It is named in the *Fauna Suecica*, *phalæna pedinicornis*, *bombyx dicta*. Aldrovandus describes it, *Insect.* p. 280 & seq. Johnston, *Inf. Mouffet*, p. 181. M. de Merian, *Europ. Lister in Goedart*, p. 82. Charleton *onom.* p. 40. Albin, *Engl. Insects*, p. 60. Reaumur, *Tom. II.*

† *Systema Nat. Ord. III. Gen. iii.*

‡ Vide Harris's exposition of *English Insects*, p. 53, where many excellent drawings of the *English* insects may be seen.

wings are of an ash-colour ; the body and the legs black, and the antennæ setaceous*.

Another moth, distinguished by its destructive effects among woollen articles of apparel is thus characterised in the *Fauna Swedica* : The antennæ are setaceous, the tongue spiral, and the thorax marked on each side with a white spot. This animal is of small size ; the wings ash-coloured ; the head, legs, and the whole under side of the body are white†.

These moths construct the abode in which they reside, of the grains of wool which they gnaw off the cloth : Their food is of the same substance ; and what greatly increases the extent of their devastations is, that every step they advance upon cloth, feeling themselves incommoded by the wool in their way, they gnaw a smooth passage for themselves, like a man with a scythe in his hand, cutting down the grass of the meadow as he goes along ‡.

These habits of the moth render them among the most destructive of insects. The most costly articles of fur are those which are not worn every day ; and for that very reason they are most exposed to their attacks. The methods for preventing their devastations may be reduced to the two following ; either we must destroy the insects, or render our clothes disagreeable food for them.

The moths may be destroyed by oil, or the fumes of tobacco. And as wool is never subject to their depredations, so long as it remains upon the sheep, the most likely

* Rai Insect. p. 204. n. 98.

† Vide Reaumur, Tom. III. & Regne Animale, Tom. II. p. 160. n. 83.

‡ Reaumur, Tom. III. p. 5.

likely method of rendering it disagreeable, is by restoring that greasy substance which is taken from it by washing, and other processes which it undergoes when manufactured †.

† Reaumur, Tom. III. Mem. iii.

CHAPTER V.

ORDER IV.—*Neuropterous Insects.*

THIS order contains six genera of insects, all of which are distinguished by four naked wings, of a reticulated structure, and by appendices springing from the extremity of the abdomen, which is unarmed with a sting: These appendices are characteristic of the male sex in this order of animals.

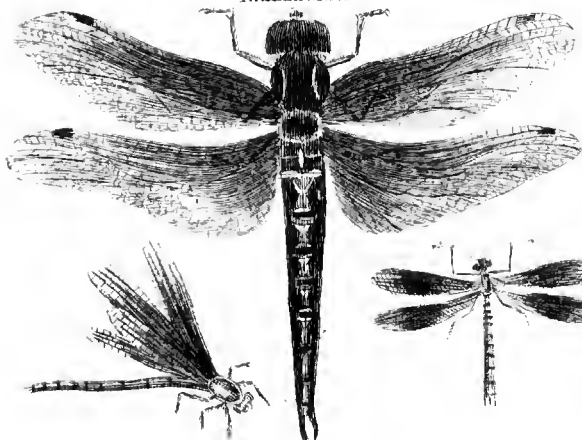
Plate VII

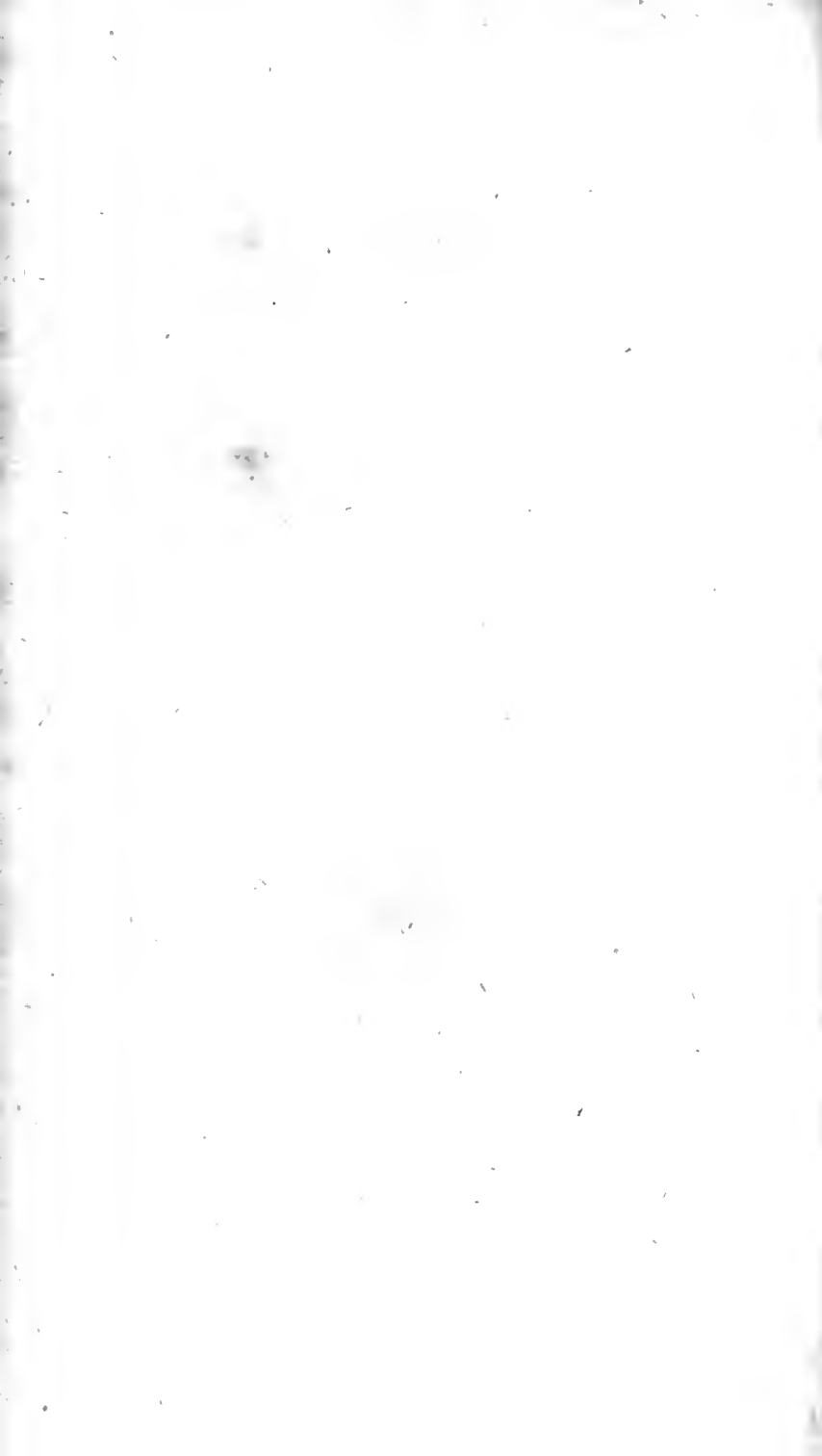


GEN. III
PHALENÆ



ORDER IV
GENUS I
LIBELLULÆ





GENUS I.—*Libellula*. *The Dragon-Fly*.

OF this tribe of large insects there are twenty-one different species remarkable by the formidable apparatus with which their mouths are armed. Their jaws are always more than two in number, and fitted for gratifying that voracity by which the libellulæ are distinguished. The antennæ are shorter than the thorax; the wings are always extended, and, in some, measure several inches from tip to tip. The male is distinguished by a kind of hooked forceps, by which the extremity of the abdomen is terminated †.

The dragon flies are universally known, from their large size, and the frequency with which they every where appear. The organs of generation are differently situated in the male and female of this tribe: In the former, they are placed upon the under side of that part of the abdomen which lies between the inferior wings; while, in the latter, they are found at the tip or end of the abdomen. The season of love in all insects, from the brevity of their lives, is necessarily short, but it is busily employed. It is only the large insects, such as the libellulæ, that are frequently seen celebrating the rites of *Venus*; and among them the operation is performed with a frequency and dispatch that seems perfectly to correspond

† Linæus Syst. Nat. Ord. IV, Gen. 5.

respond with the transient nature of their existence, and the numerous race they transmit to posterity.

The addresses of the libellula to his female seem carried on in a rough and intrepid, but efficacious manner. He hovers about on the wing, till the object of his amours make her appearance; he then watches an opportunity of seizing her by the head with those pincers with which his tail is armed. It is thus that the ravisher travels through the air, till the female, yielding to superior strength, perhaps to inclination, forms her body into a circle, that terminates at the genitals of the male, and thus accomplishes the great purpose of nature. It is while these kind of rapes are perpetrating, that the libellulæ are seen coupled in the air, exhibiting the form of a ring*.

The female, when pregnant, retires to the side of a ditch or pond, when, by the assistance of a stick or reed, she creeps, or lowers herself down, by moving backwards, till the tip of the tail is immersed about half an inch in the water; she is then seen seized with a kind of trembling or shaking of the body, during which efforts she deposits a single egg in the water; afterwards she immerses her tail a second and a third time, when the same operations are performed. The tail is withdrawn from the water, by contracting its annuli; and by the pressure of these upon each other, the egg is gradually forced from the ovary to the extremity of the tail, from whence it is ultimately separated, by shaking that part in the water.

The eggs thus protruded by the libellula are of a white colour, and oblong form, resembling those produced by the vomitoria or common blow-fly. The caterpillar
which

* Barbut's *Genera Insectorum*, p. 205.

which issues from these eggs, at first feeds on small aquatic insects, gradually acquiring more voracity and boldness in the pursuit, in proportion as its strength increases, at length it becomes so insatiable that it is said to devour even those of its own kind †.

The form and colour of these worms are extremely disgusting: They are supposed to have gills like fishes; and beneath the head is placed an instrument excellently adapted for seizing and holding their prey. It is furnished with a forceps at the end, and can be advanced or drawn back with all the agility of the human hand.

The caterpillar remains in the same state for nearly twelve months before it has attained to its full size: When the period of transformation has arrived, the worm repairs to the margin of its pond in quest of a convenient place of abode during the season of its inaction. It there attaches itself to a plant or piece of dry wood; and the skin, which has gradually become parched and brittle, at last splits opposite to the upper part of the thorax. Through this aperture the winged insect quickly pushes its way; and being thus extricated from confinement, begins to expand its wings, to flutter, and finally to launch into the air, with that gracefulness and ease peculiar to this majestic tribe ‡.

No particular time seems appointed for the metamorphosis of the libellula into its winged state; the different species are continually emerging from the water from *April* to *August*: For as the times of copulation are various and frequent during the whole summer, so the larvæ or caterpillars are found of different sizes, according to their age. The smaller kinds, however, generally
make

† Harris Exposit. p. 51.

‡ Barbut, ubi supra.

make their appearance before the largest ; because, from breeding in shallow water, they sooner feel the influence of the sun on the approach of spring.

The manners of these insects must no doubt be greatly altered by a change, which not only confers upon them a new form, but introduces them into a different element. The complete insect, in its winged state, however, still continues to pursue the same food, and remains insectivorous. The lepidopterous insects, the butterflies, and phalænæ are destined for the support of the larger libellulæ ; they are a part of those numerous tribes that are appointed to confine those prolific genera within due bounds †.

The *libellula grandis* is the largest of this genus found in *Britain*, and is perhaps not inferior in bulk to any insect which this country produces : The fore part of the head is yellow ; the eyes brown, and so very large, that they meet upon the top of the head. The thorax is dun coloured, with two oblique bands on each side, of a lemon colour. The abdomen, which is very long, is likewise of a deep buff colour, often spotted with white upon the top and bottom of each segment ; the small appendages which terminate the abdomen, are in this species very long ; the wings have more or less of a yellow complexion, and are distinguished by a brown spot on the exterior edges ‡.

The *libellula forupata* § is another large insect of this genus, which expands four inches and an half. The nose is yellow, having a black line on the prominent part ; the thorax is black, with several broad yellow stripes,

† Harris Exposit, p. 51.

‡ Barbut, p. 206.

§ Syst. Nat. Ord. IV. Gen. i. No. 11.

two of which appear on the front, and two others between the ligaments of each pair of wings; the abdomen is also black, having two streaks resembling a crescent on each segment; the wings are transparent, and, but for a slight tinge of amber, almost white*.

The libellula whose body is of a shining green, and the wings of a gilded brown, is smaller than either of the foregoing, and is thus characterised by Mr. Ray†: The body is green and azure; the wings adorned towards the middle each with a large spot, of a deep blue, inclining to black. The feet of this insect are black, and the wings have no spot on their exterior margin. From the brilliancy and richness of its colours, it has been called the king's fisher; it frequents little rivulets of water, over-shaded with bushes‡.

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* Harris's Exposit. p. 78.

† Insect

No. 9.

‡ Harris's Exposit. p. 99. fig. 1.

GENUS II.—*Ephemera*. *The Day Fly*.

THE mouth of this genus has neither teeth nor palpi; the insects which compose it have two, sometimes three stemmata, situated above the eyes, and larger than is usual in other insects. The wings, when the animal is at rest, stand erect, the upper much larger than the inferior pair; the tail is furnished with an indefinite number of setaceous appendices †.

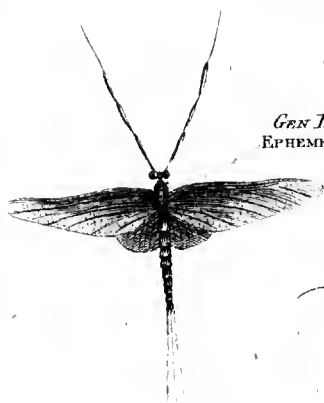
The insects of this genus have been denominated ephemeræ, or day flies, from the shortness of their lives; but the life of a day is in proportion to that of several animals of this class, what the lives of the antedeluvian patriarchs were to ours. The period allotted by nature for the existence of certain ephemeræ is only a few hours; of some, even less than an hour. To some insects, indeed, that bear the generic characters of ephemeræ, she has been more indulgent; for these are destined to see more than one revolution of the sun ‡.

All the day flies are produced from hexapodal worms, which are afterwards transformed into chrysalids, of a form nearly resembling their own; like the parent worm, they walk on the same number of legs. Both the worm and the chrysalis are aquatic, and are provided with gills like

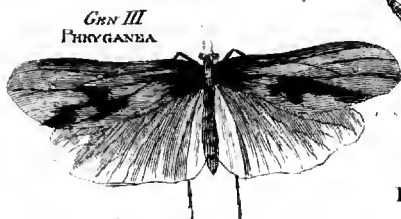
† Syst. Nat. p. 966.

‡ Reaumur, Tome VI. p. 13.

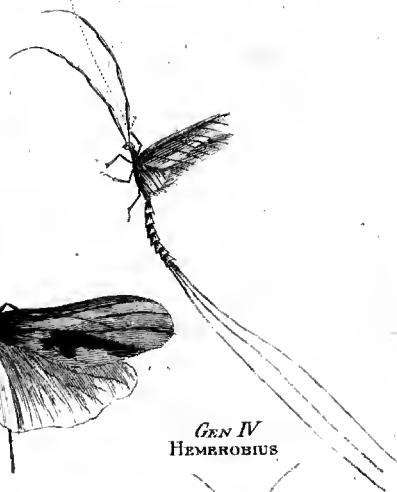
Plate VIII



GEN II
EPHEMERA



GEN III
PHRYGAEA



GEN IV
HEMEROBIUS



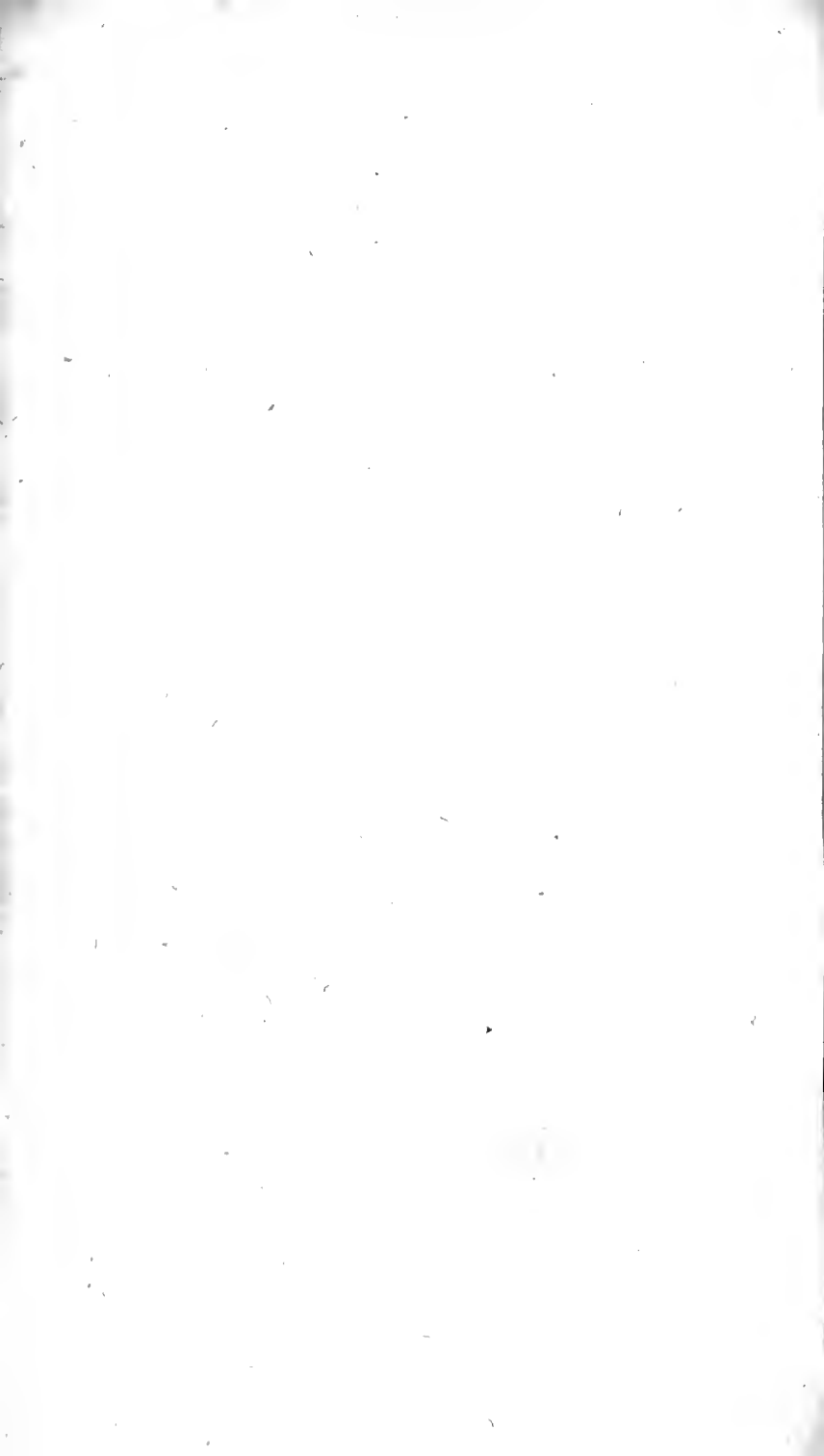
GEN V
MYRMELION



GEN VII
PANORPA



GEN VI
RAPHIDIA



like those of fishes, and probably destined to serve the same purpose.

They are seen arranged along each side of the abdomen, one on every segment, from the first to the sixth or seventh. When the insect is at rest, these branchiæ are seen moving with great rapidity; and from their position, *Reaumur* has distributed the chrysalids of ephemeræ into three distinct classes *.

Some of these chrysalids walk or swim up and down in the water, attach themselves to plants, or conceal themselves below the stones: Others have the first pair of feet formed for digging into the ground, and besides, are provided with two instruments on the forehead, still better adapted to that purpose: with these, each animal digs itself a hole on the river bank, where it constantly resides. The brinks of the *Marne* and the *Seine* in *France* are seen thickly perforated by these animals: The holes thus excavated are generally nearly on a level with the surface of the water, and have commonly two apertures; one by which the worm enters, and another by which it returns.

These animals, while they remain in these subterraneous retreats, offer but few materials to the naturalist who would record their history: Though many of them remain there for two years, and feed upon the earth in which they are lodged, yet they are effectually concealed during all that period from his observation. Probably the most interesting incidents of their lives are those which happen in our view, and are confined to the narrow space of a few hours. Their story becomes then eventful; for in that short period they are transformed into flies, the fe-

3 O 2

males

* Tome VI. mem. ix.

males impregnated, and the eggs deposited; and these functions are no sooner over, than the active beings who performed them finish their operations for ever*.

On the banks of the *Siene* and the *Marne*, in the vicinity of *Paris*, the ephemerae exhibit a singular spectacle for some days about the middle of *August*. For several hours after sunset, they rise in such vast multitudes, that they appear like the flakes pressing upon each other in a heavy fall of snow. By and by, the whole surface of the earth is covered with the swarms that have fallen upon it, after having finished their short existence.

The chrysalids that remain under the water begin their transformation in the evening, and complete it by eight or nine o'clock; an operation painful and difficult to other insects, is with them performed with great celerity and apparent ease. No sooner has the chrysalis reached the top of the water, than its prison bursts open, and the winged ephemera soars into the air. Millions after millions are thus constantly taking wing, till the air becomes darkened with their numbers: They are in that element but an instant, when abundant showers of them fall back to the ground.

The females, after their fall, are busy in performing the last function of their lives, which is, depositing their eggs. Such as have dropped upon the ground leave them there; while those that have tumbled into the river produce two separate clusters of ova, each containing no less than three hundred and fifty. All this is the work only of a moment; for other insects are not sooner delivered of a single egg, than the ephemera of seven hundred.

Some

Some naturalists have pretended, that these eggs were all impregnated, like those of fishes, by a kind of sperm ejected from the body of the males. This opinion, however, is combated by *Reaumur**, as being attended with many difficulties. That naturalist, by the help of a lighted torch, has examined these animals narrowly in their winged state; and although that method of surveying insects, whose numbers occasion so much confusion, be uncertain, he asserts, that he observed them engaged in short copulations; an assertion the more probable, since, if the ephemeræ copulate, that act behoved to be more instantaneous than in any other race of beings.

Another species of the day fly is seen to cast a skin, even after it has arrived at its winged state: Thus, however slender their wings might at first appear, they must, as well as the whole body, have been enveloped in a coat which the animal then drops †.

The ephemeræ *vulgata*, or common day fly, is the largest of these insects with which naturalists are yet acquainted; it carries at the extremity of the abdomen three brown threads, nearly of equal length with the body, which is all over brown. The wings are ornamented with brown veins, which form a net-work.

In *Carniole*, a province of *Germany*, this species is so numerous, that the peasants think they make a bad harvest of them, if they do not unload upon their land many carts filled with these insects. They make excellent manure; but the number of animals of so small a size necessary to supply the quantity, must exceed the power of imagination to conceive.

* Vide *Biblia Naturæ*.

† *Reaumur*, Tome VI. Pref.

GENUS III.—*Phryganea*.

THESE insects, as well as the last, are of a small size, and are at first sight easily distinguished by the antennæ, which are longer than the thorax, or even the whole body. The mouth is without teeth, but furnished with four palpi; the four wings are incumbent; the under ones, when unfolded, are very broad in proportion to the size of the animal that wears them*.

There are twenty-four species ranged under this tribe, which *Linnaeus* has divided into two families; the first characterised by having the setæ which spring from the extremity of the abdomen truncated like the beards of an ear of corn; and the second, by having the abdomen simple, without appendices.

The phryganææ, before they become inhabitants of the air, have, like the ephemeræ, been aquatic animals; their apartments in the water are singularly constructed; their form is that of a tube, the inward texture of which is silk, while it is outwardly composed of sand, straws, or chips of wood. When the animal within finds its chrysalid state approach, it stops up the ends of this tube with threads of a loose texture, through which the water may penetrate, while it prevents the approach of voracious insects.

The

* *Systema Naturæ*, Ord. IV. gen 3.

The precautions of these aquatic larvæ, in securing themselves in these retreats, are also necessary to protect them from fishes, who are very greedy of them. Some of the phryganææ of stagnated water, such as lakes and ponds, cut the water lentil in regular squares, from which they construct their edifices. The common trout is one of their greatest enemies; and many other fishes covet them so eagerly, that, when stripped of their crust, they make excellent bait.

The phryganeæ bicauda of *Linnaeus* frequents equally the banks of rivers and of standing pools; the wings are a third longer than the body, narrow at the top, and broad below, and reticulated with brown veins; the colour of this insect is a dark brown, with a single longitudinal streak passing across the head and thorax; the antennæ are long, filiform, and of the same colour with the legs and body*; the appendices of the tail are of equal length with the antennæ.

The phryganeæ saltatoria is one of the smallest species of this genus; the wings are decorated each with a green and white spot†; the antennæ are longer than the body; and when examined with a microscope, appear velvety; the wings are of a bright colour; the small veins by which they are reticulated being white at the base, and blackening towards their extremity‡.

* Barbut's Gen. Insect. p. 216.

† Fauna Swecica, phrygan. spec. II.

‡ Règne Animal, Tome II. p. 117.

GENUS IV.—*Hemerobius*.

THIS tribe of insects have obtained the name of hemerobii from the shortness of their lives, although they continue in their winged state longer than a day. This genus is distinguished by having the mouth armed with two teeth and four palpi; the wings hang down, without being folded; the antennæ are setaceous, advanced before the head, and longer than the thorax, which is convex*.

Nature seems to have spread plant lice upon almost every plant, for the maintenance of thousands of her offspring. In their larva state, the hemerobii are great devourers of these animals; and from that circumstance they have obtained the name of lions of plant lice†. Even after their transformation, the hemerobii retain their carnivorous habits: Not satisfied with making war upon the plant lice, who tamely suffer themselves to be devoured, they do not spare those of their own kind.

The moment these insects enter upon life, they find themselves, by the precaution of their ancestors, situated among thousands of small animals, which, without any effort, they destroy. In less than a minute after the plant louse has been seized, the whole viscera and juices are sucked from its body. Some species make a covering for their body of the carcases which they have thus emptied, and carry them about as trophies upon their backs.

The

* Syst. Nat. p. 911.

† Reaumur, Tom. III. mem. 11.

The eggs of the hemerobius offer a curious spectacle to the observer, and for a long time were deemed parasitical plants. Each of them is supported upon a long pedicle, resembling the stalk of a plant, of which the egg appeared to be the flower. In this form they are seen in clusters upon leaves, where, as soon as they are hatched, they find subsistence among the surrounding plant lice.

In about fifteen days, the larva attains to its full growth, when it weaves to itself a small white silken cocoon of a close texture: there the hemerobius lodges about three weeks, till its metamorphosis into a winged animal is completed: If, however, the cocoon has not been spun till Autumn, it remains in it till Spring, when it is transformed. The flight of these insects is slow and heavy; some of them have an excrementitious smell.

The hemerobius perla of *Linnaeus* is one of the most beautiful animals of this tribe: The eyes are golden, and the whole body of a yellowish green*; the wings are very large, diaphanous, and of nearly the same colour with the body; it inhabits garden plants, and when touched, has the smell of ordure†.

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* Rai Insect. p. 274. † Vide Mouffet, p. 62. & Grew, mus. p. 156.

GENUS V.—*Myrmoleon*. *The Lion Ant*.

THE mouth of this voracious race is armed with jaws, two teeth, and four palpi. In the male sex, the tail is furnished with a kind of forceps, formed by two straight threads; the antennæ are in the shape of a club, and of equal length with the thorax.

The lion ant, concerning which so much has been said by naturalists, is of five kinds, all distinguished by an uncommon voracity, and cunning in securing their prey; their habits of rapacity seem born with them; and during their whole lives they are supported by the game which they catch. At first sight, these animals seem but ill fitted for their manner of life: The most unwieldy insect can easily escape from them; for they cannot advance upon it a single step; all its progress in walking being backwards; by stratagem, however, this lion masters insects far superior to it in strength. In the loose sand it digs a hollow resembling a funnel, where it takes its station at the bottom, every part being concealed except the forceps with which the head is armed. This instrument, which it can open or shut at pleasure, is happily constructed for seizing and penetrating the hardest insect; and unhappy is the animal, who, in pursuing its journey, stumbles into this cavern. In vain it endeavours to scramble up by the edges, which are continually giving way under its feet; it tumbles to the bottom, where it is pierced by the forceps of the lion ant lurking below.

If

If the insect be small, and the grains of sand, notwithstanding the declivity of the funnel, do not give way under its feet, the myrmeleon has another invention by which he renders himself master of his prey: With his head, which is flattened, he throws up repeated showers of sand from the bottom of the funnel, which falling upon the sides, force down the insect till it comes within reach. The fatal instruments with which this animal seizes its prey, are each a sort of mouth or trunk, by which it sucks out the whole intrails before it is drawn out of the body*.

When the lion ant has attained its full size, it constructs for itself an edifice, the external parts of which are particles of sand or earth combined together by silken threads: the interior cavity is lined with pure silk, white and glossy like satin. Within this ball the myrmeleon is changed into a chrysalis, of a curved or semicircular shape, displaying all the parts of the perfect insect that is soon to issue from it.

After the chrysalis bursts, the winged insect which makes its escape is of a gray colour, with a long slender body, resembling the libellula. In this country, the myrmeleon is very scarce; a few, however, are found to breed among the loose earth at the bottom of walls which have a south exposure. In that dry, pulverized, and sandy earth, their eggs are protected from rain, till they are hatched by the sun. *Vallisneri* and *Ponpart* first gave the history of the lion ant; that of the former is in the form of a dialogue between *Malpighi* and *Pliny*, in which the modern informs the ancient naturalist of the singular manœuvres and metamorphosis of these animals.

3 P 2

Externally,

* Reaumur, Tome VI. mem. x.

Externally, the lion ant presents no features that are remarkable. The head is broad, of a brown colour, spotted with yellow: On each side are placed two large eyes, and beneath them the antennæ, thickening towards the point, and shorter than the thorax. The neck is longer than that of most insects, and can be stretched or shortened at pleasure. The thorax is of a dirty white, and upon the annuli which compose it are seen by the microscope, the organs of respiration †.

† Reaumur, Tome VI, mem x. p. 339.

GENUS VI.—*Panorpa*. *The Scorpion*,

FORMERLY there was only one species of these animals known, till *Linnaeus* discovered four different kinds, which he has enumerated in the latest editions of his system of nature. They are all distinguished by a cylindrical proboscis, of an horny transparent substance; by two palpi, and three stigmata above the head. The tail of the male sex is furnished with a weapon resembling the dart of a scorpion; a circumstance from which almost all naturalists have given it that name †.

The formidable instrument with which the tail of the male scorpion is armed, is not formed for any hostile purpose; it is used by him in laying hold of his female during their amorous embraces.

There are varieties of the common scorpion; that most frequent is of a dark brown, and yellow upon the sides. The tail is formed by the three last segments of the abdomen, and is of a maroon colour; the wings, which are as long as the body, are diaphanous, and reticulated, with fibres and streaks of a brown colour. There are
some

† Vide Aldrov. Mouffet, p. 62 & Frisch, p. 29.

some varieties of this singular animal: Instead of the streaks on the wing, we find some with a single transverse stripe of black irregularly placed across the wing; others are found with their wings entirely white, excepting the tips, which are black.

GENUS VII.—*Raphidia**.

THIS tribe is characterised by two teeth, a flat head, of a horny substance, four palpi, and three stemmata; the antennæ are filiform, and as long as the thorax; the anterior part of which is lengthened out like the neck of a bird. The tail of the female is terminated by an appendice resembling a flexible crooked bristle †.

There are only three species of this genus yet discovered; the first of which is termed the ophiopsis, from the figure of its head and long thorax. Its form is the most singular, perhaps, of any animal in this class of beings. The shape of the head is broad before, and narrow where it joins the thorax, resembling a heart; it is flat, smooth, and black like horn: the thorax is of the same colour, narrow, and cylindrical: the antennæ are setaceous, and composed of many articulations: the abdomen is brown, marked with white transverse lines: the wings are radiated and diaphanous; the exterior edges in some subjects have each a black spot: the anus terminates in a curved setaceous bristle, about half the length of the abdomen ‡.

* Barbur's Gen. Insect. p. 227.

† Syst. Nat. p. 916.

‡ Regne Animale, p. 112.

CHAPTER VI.

ORDER V.—*Hymenopterous Insects.*

THIS order contains all the bees, hornets, wasps, and ichneumons, insects which are distinguished from those which we have already reviewed, by possessing a sting, and four membranous wings. Some of them the industry of man has turned to advantage, by reducing them into a domestic state, while the greater part still remain the free servants of nature, and may be regarded among the most inveterate enemies which men have to dread among this race of animals.



Plate IX.

ORDER V.

GENUS I.
CYSIPS



GEN. II.
TENTIREDO.



GEN. V.
SPHEX.



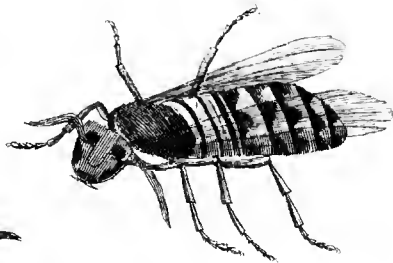
GEN. IV.
ICHRUMON.



GEN. VI.
CHRYSID.



GEN. VII.
VESP.Æ.



GENUS I.—*Cynips*. *The Gall Fly*.

THE mouth in this genus is armed with jaws, but has no proboscis; the sting is spiral, and most frequently concealed within the body.

Those innumerable and various excrescences which are seen upon the leaves, branches, and roots of trees, are all the productions of different kinds of insects. Of these, some so nearly resemble the natural productions of the plants, that they are sometimes taken for their fruit or their flowers: A particular kind of ivy produces galls that are actually eaten as fruit by the peasants in some parts of *France*; and in *Constantinople*, there are some of these productions brought to market for sale*.

Some of these excrescences have within a single large cavity, in which several insects live and associate together: Others have a number of smaller cavities, with communications between them; a third class contain a variety of separate cells, sometimes a hundred, each occupied by a single insect, which has no communication with the rest. These productions are also of various sizes, forms, and consistency; some are spongy, while others are hard like a nut. Of the latter kind, those are best known which are imported from the *Levant* for the purpose of dyeing cloths.

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All

* Reaumur, Tom. III. Mem. xii.

All these apparently monstrous productions are occasioned by the puncture of insects when depositing their eggs, or by their bite when collecting food; in both cases, the animals subsist upon it; and the more they eat, the more vigorously does the protuberance continue to grow, till at last it forms a sort of impenetrable fortress, to protect its inhabitants till they have gone through their different metamorphosis, and at last taken wing. But the best concerted schemes of insects, and of man, are unequal to secure either from every accident that may occur. Impenetrable as the habitation of the gall fly may appear, its walls are often perforated by other insects, who deposit eggs there, that are soon to become rapacious worms, and to lay the dwelling waste.

The ancient opinion concerning the animals found in these receptacles was, that they were spontaneously produced from the rotten wood of the plant. Afterwards, it was believed, that the roots of plants had the power of sucking up, along with sap from the earth, the eggs of insects, and that these were animated as soon as they stopped circulation through the fibres of the tree. Even the intrepid *Rhedi*, who combated the prejudices of his age with successful boldness, had recourse to a kind of vegetative soul in plants, by which he accounted for the production of these animals. *Malpighi* at last explained their true origin, from eggs deposited there by those of this kind. The same naturalist gives an ingenious account of the formation of these excrescences themselves, by means of a liquor deposited by the fly, mixing with the sap of the tree, and causing a fermentation at the part. The simple extravasation of juice from the wounded
plant,

plant, is however, sufficient to account for the largest galls that have yet been observed *.

The *cynips quercus folii* †, is of a burnished shining brown colour; the antennæ are black; the legs and feet of a chefnut brown; and the wings white, without marginal spots. Those smooth round galls that are seen under the oak leaves, are the birth places of these insects: commonly a single one is found in each gall. Instead of the natural inhabitant of this gall, a larger insect of a brown colour is sometimes seen to proceed; this is the ichneumon, who is neither the builder nor the legitimate owner of the dwelling, but a parasite produced from an egg deposited there by his progenitors.

Of all the trees with which we are acquainted, the oak affords food and an habitation to the greatest number of insects. There are above fifty different species that in this country inhabit that plant, and probably in warmer climes the numbers of its tenants is much greater. The *Norway* ink, so celebrated for its colour and permanency, is the produce of a gall in that country, similar to that seen upon our oaks in the month of *June*. The fly which produces it is perhaps the same ‡.

The gall fly of the rose, *cynips rosæ*, is found on the gall of that shrub, and is distinguished by the black protuberances of the antennæ; the abdomen below is ferrugineous, the feet yellow, and the wings without spots §.

* Reaumur, Tom. III.

† Syst. Nat. spec. 5.

‡ Barbut, p. 234.

§ Fauna Svecica, No. 938.

GENUS II.—*Tenthredo*. *The Saw Fly*.

THE family of saw flies have two jaws, but no trunk or proboscis. Their sting, which is almost hid by the abdomen, is of a singular structure, being composed of two plates, and dentated like a saw. The abdomen is closely united to the thorax, without the intervention of a small stalk, as in the former and succeeding genera.

From the shape of the antennæ, the tenthredines have been arranged into six tribes, consisting of about thirty-nine different species. The most remarkable fact in their history seems to be the application of her saw by the female, in cutting out a space in the twigs or buds of trees to contain her eggs: The whole process is performed with great ingenuity; and from the tameness of these animals, may easily be observed.

The eggs thus deposited have the peculiar property of increasing their size every day, till the young worms are ready to burst from them. The worm of the tenthredo has often been taken for the silk worm; an animal which it nearly resembles, except in the feet, which are more numerous: Like the silk worm, too, the young tenthredo constructs a cocoon in which it may undergo its last transformation; and its edifice consists of two coats of silk, the external coarse and strong, the interior of a finer substance*.

The

* Reaumur, Tom. V. Mem. iii.

The *tenthredo femorata* is, as the name imports, burdened with two large thighs; the whole insect is black, except the antennæ and tarsi of the feet, which are yellow †.

The *tenthredo luctuosa alni*. This quiet, melancholy, and beautiful fly is found among alder plantations, and is often fatally entangled in the clammy juice that issues from their leaves. The head and trunk are of a fine yellowish brown; the antennæ a more dusky shade of the same colour, and the eyes blue: The body is coal black; the segments of a brownish yellow; the wings are of a pale yellowish brown, with little yellow risings upon their fibres, and a margin of yellow ‡.

There are no less than fifty-five species of the *tenthredo* enumerated in the *Linneæan* system; but the *Swedish* naturalist seems himself to suspect, that some kinds are twice mentioned. Colour, though an obvious, is no certain character of insects. In some, it differs with the season, in others, with the sex; and in all it glows according to the creature's health and vigour.

† Syst. Nat. spec. I.

‡ Barbut's Gen. Insect. p. 238.

GENUS III.—*Sirex*. *The Tailed Wasp*.

THE animals of this genus are not so numerous nor diversified as the last, but are greatly superior in size; the mouth is armed with two strong jaws; the palpi short, and articulated; the antennæ are filiform, and consist of near thirty articulations; the sting is long, stiff, serrated, and projecting beyond the abdomen; the wings are plain, and of the shape of a lance; the abdomen is slender, terminating in a point towards the sting †.

Of the seven different kinds of sirices, the gigas of *Linnaeus* is the largest; the male, indeed, as is frequently the case, is one third less in size than his female, and has neither spine nor sting at his extremity: That instrument, however, is formidable in the other sex; it consists of three laminæ; two at the sides, which serve for sheaths, and one in the middle, somewhat serrated, which is the real sting.

The wings of this species are large, yellow, and veined; the thighs short, and black; and the legs, as well as the tarsi, are yellow; the antennæ are of the same colour, and are inserted into a black head, which has apparently

† Syst. Nat. Ord. V, Gen. 3.

parently four eyes. What appears to be the second pair of eyes is only two large yellow spots behind the other. The belly is cylindrical, and consists of nine different segments, some of a black, and others of a yellow colour*.

* Barbut's *Genera Insectorum*, p. 242.

GENUS IV.—*Ichneumon*.

THIS genus contains a numerous list of insects, whose manners appear singular, even amidst the wonders which this class of beings is continually displaying. It contains upwards of seventy different species, all characterised by the antennæ, which have more than thirty articulations; by the mouth, armed with jaws, but without a tongue; and by the abdomen, which is joined to the body by a pedicle or stalk, and which terminates in a projecting sting, inclosed in a cylindrical sheath †.

We have already had occasion to observe one striking peculiarity in the manners of some insects of this genus, who make their way into the body of the caterpillars of different kinds, and there deposite their eggs. It is from the signal services which they perform, in destroying caterpillars, plant lice, and other insects, that they have derived their name: These animals are devoured by them, as the genuine ichneumon, or mangouste, destroys the crocodiles.

As the species and varieties of the ichneumons are prodigiously numerous, so their manners are extremely diversified: In the general outlines of their character, they all agree, being remarkable for their depredations among the insect tribes. In some, the female is furnish-
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† Systema Nat. Ord. V. Gen. 4.

ed with a wimble, attached to her abdomen ; and with this instrument, though delicate, she is capable of piercing through lime and plaster. The larvæ of wasps and mason-bees are the devoted prey of this species, which no sooner espies one of their nests, than with its wimble it perforates the mortar of which it is constructed. This operation, which is performed with singular dexterity, is no sooner finished, than it deposits its eggs in the inside, to the number of one, two, and sometimes more. Some are contented with gluing their ova to the skin of a caterpillar, while others penetrate through it, and deposit the egg in its body †. The ova hatched within the caterpillar, after being quickened into life, preys upon the intestines of that animal, without, however, destroying its vitals. Upon the life of the one animal that of the other seems to depend ; and the ichneumon spares the caterpillar upon which it feeds, till it is about to enter into its chrysalis state. In the mean time, the caterpillar in which it is enclosed is apparently healthy, and prepares to undergo the same transformation ; a function which it is seldom able to accomplish, because the interior parts essential to the butterfly, though not to the worm, are destroyed ‡. Often these caterpillars, which have been the cradle of thirty or forty ichneumons, are seen fixed to the bark of a tree, as if they were sitting upon their eggs ; and it is discovered that the larvæ which were within their bodies have spun their threads, with which, as with cords, the unhappy caterpillar has been fastened down, and perished miserably.

The eggs of the ichneumons which have been simply agglutinated to the outside of the larvæ, remain not long

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† Reaumur, Tome II. Mem. xi.

‡ Idem, Tom. II. Pref.

in that position; for the young animals produced from them easily make their way into the body of the caterpillar on which they were placed.

Various are the sizes of this carnivorous race: Some are so small, that the plant louse, the curculio, or the spider's egg, is made the cradle for their young; and all the insects upon which they fix undergo the same fatal destiny, sooner or later perishing by their depredations. Those carcases of plant lice which are seen motionless on the rose-tree leaf, have been each the habitation of a small larva, which, after having devoured the intrails of the plant louse, has performed its metamorphosis under the empty skin, from which it has afterwards sallied forth a winged ichneumon.

But though many of these insects are so extremely minute, there are others, which, from their size and intrepidity, are formidable to the spider. Many of these challenge that animal to open combat, and having run him through with their stings, tear him to pieces; thus avenging the whole race of flies of the injuries they suffer from that most dreaded enemy of their kind.

Ichneumon aphidum. This insect is almost wholly black; the abdomen, towards the base, and the feet, are yellow; the antennæ are black. This species, when about to deposit its eggs, bends the abdomen till the anus nearly approaches the thorax, and thus penetrates into the anus of the plant louse, in which it lodges its progeny †.

The parasitic ichneumon ‡. The larva of this insect adheres to the body of a caterpillar, upon which it feeds.

The

† *Regne Animale*, Ord. V. Gen. iii. spec. 2.

‡ *Vide Actes d'Upsal*, 1736, p. 29, N. 11.

The head and the antennæ are black, the latter longer than the body ; the feet are yellow *.

The black ichneumon †. The antennæ, head, thorax, and abdomen of this species are all black : it is farther distinguished by the three filiform appendices of the tail, which are longer than the body, and that in the middle of a red colour. It frequents the meadows and gardens ‡.

* Derham's Physico Theol. l. 8, c. 6.

† Vespæ Ichneumon tota nigra, Rai Inf. p. 256.

‡ M. de Geer, Vol. l. p. 703.

GENUS V.—*Sphex*. *The Savage*.

THE mouth of this tribe is armed with jaws, but has no tongue; the antennæ have ten articulations, and the wings are extended, and laid horizontally upon the back; the sting lies concealed within the body.

This genus contains insects, perhaps the most fierce and rapacious of this class of beings. The savage, or ground bee, does not feed upon honey, or accommodate its young with that kind of provision. They attack insects much beyond their own size, and that whether they are defenceless or armed; for they are provided with strong jaws, and a sting poisoned with a liquor fatal to every animal they engage. The savage seizes boldly on the insect he attacks, and gives it a stroke of amazing force. After this first encounter, he falls down, as if he had himself received the mortal blow; but it is only to rest from his fatigue, and to observe the effects of his prowess. By and by, the wounded animal dies; and while yet palpitating with life, the savage devours those parts which he finds most palatable, leaving the greater part entire.

It is thus that the sphex riots in the blood of hundreds of insects; and his family is no sooner increased, than the carnage becomes proportioned to the number of young he has to support. After the female has deposited her eggs in the bottom of a cell dug in the ground, or in the
mud

mud wall of a cottage, the whole apartment is crammed with multitudes of living and dead insects, destined to be the food of the future progeny. Thus their houses, like the renowned caves of the giants, are strewed with dead. This operation is no sooner over, than the parent insects stop up the hole at the entrance of the cell, to prevent the escape of such of the wretched captives as may yet be alive. The young, when they leave their eggs, find themselves amply supplied with provision. They devour, one after another, all the carcases with which they are provided; and when their last fly is eaten, they have no longer occasion for food, but are changed into chrysalids, which afterward become savages of one species or another, according to that of the parent pair*.

Sphex femi aurata viridis †. The head, thorax, and abdomen of this beautiful species are of a finely gilded blue; the antennæ are yellowish; the eyes of a gilded brown, and legs of a dark blue.

The *spirifex*, or turner savage, is of a chestnut brown, with a shade of blue; the eyes are large and black; the antennæ brown; the body is ferruginous; the thorax and abdomen connected together by a yellow thread; the wings are of a dusky brown, and the sting yellow ‡.

* Reaumur Tom. VI mem. 9.

† Syst. Nat. Ord. V. Gen. v. sp. 35.

‡ Barbat's Gen. Insect. p. 253.

GENUS VI.—*Chrysis*. *The Golden Fly*.

THIS tribe, like some of the preceding, has no proboscis, but a mouth furnished with jaws: The antennæ are filiform and bended, consisting of several articulations, of which the first is the longest; the abdomen is arched underneath with a scale on each side; the anus is dentated, and armed with a projecting sting; the body is covered above by the wings, through which it shines as if gilded*.

Among this family the ignita, or flaming chrysis, stands distinguished by its resplendent colours. The fore part of the head is green and gold, and the hind part of a beautiful azure; the thorax is likewise azure, with a mixture of green: The abdomen is green and yellow before, and behind of a copper red, resembling that metal when highly polished†.

* Syst. Nat. Ord. V. Gen. 6.

† Barbut, p. 256.

GENUS VII.—*Vespa*. *The Wasp*.

THERE are no less than twenty-eight species of the wasp; many of which are universally known. The common characters by which the tribe is distinguished, are, the jaws with which the mouth is armed; the four wings, the first pair of which are folded, and the sharp pointed sting which is usually concealed within the body; the abdomen is joined to the thorax by a short stalk, and the whole body is smooth*.

The crabro or hornet is not found in *Scotland*, though common in *South Britain*. The antennæ, head, and legs, are of a brown or chestnut colour: the abdomen is of a fine orange brown; but on the extension of the annuli, it discovers on each side a line of black: the wings are of the colour of amber; and the animal, for size, merits the first rank among the vespæ. It builds its nest in the body of decayed trees†.

Vespa vulgaris, the common wasp. The thorax of this species is black, surrounded on the anterior part by a yellow line; the abdomen is of a golden yellow, having triangular spots down the back part, and black ones on each side.

The wasps in general seem to fill up a middle rank between the ichneumons and the bees; like the former, they

* Syst. Nat. p. 984.

† Harris's Exposit. Tab. 27, p. 327.

they are rapacious and carnivorous, and, like the latter, they construct hives, and sometimes feed on the produce of flowers; they devour fruit, butcher meat, and carry on continual hostilities against almost every other species of fly: they are at once the rivals and the enemies of the common bee; many of which annually perish by their attacks.

Almost every person must have seen the establishment made under ground by the common wasp. It is a kind of subterraneous city, which at certain seasons of the year contains many thousands of inhabitants, and is constructed nearly with the same ingenuity and elegance as that of the domestic bee. Like it, it is internally formed with combs, consisting of a number of hexagonal cells, all enveloped under one common covering, like coarse paper, which is constructed with great art. In this particular they excel the common bee, which contents itself with the cover afforded by the hive, or with the trunk of a rotten tree, in their wild state.

Though the wasps generally make choice of some large hole under ground for the construction of their nest, they have nevertheless much labour to undergo in removing protuberances, and carrying away earth, till it is brought to that spherical figure which suits their purposes. This work completed, they next construct that paper like covering with which the whole hive is lined. The combs in which the cells are lodged next claim their attention: These are ranged horizontally in different stories, sometimes twelve or fifteen above each other, all supported by colonades, between which the whole citizens of this subterraneous commonwealth are seen at times to walk, like men in the streets of a town. The cells of the wasps are

not constructed with that geometrical skill which has been so often admired in those of the bee ; but they are not on that account the less adapted to the purposes they are destined to serve. Each comb has only a single range of cells, with their mouths opening below. They are intended, not for the reception of honey, but for the habitation of the young, which are fed twice or thrice a-day, by the morsels carried in by their parents. For the more commodious reception of their food, each of the larvæ has its head turned downward opposite to the mouth of its cell, ready to receive its meal when offered*.

There are, however, many varieties in the construction of wasp hives, all suited to the views of the different species who inhabit them. Some have only a single row of cells, placed vertically, like those of the bee, and the mouths facing the sun : The reason of this variety seems to be, that some kinds require the heat of the sun to hatch their eggs ; an advantage which could not be obtained, were there more rows of cells, or were they placed in a different manner.

As in a hive of bees, so in that of wasps, there are three different kinds of animals : At certain seasons, it contains only a single female, and a number of neuters or mules, who are of no sex ; at other times it contains some hundreds of females, and still a greater number of males. The former are of a size so superior to the mules, that one weighs against eight ; even the male wasp is not more than half the weight of his female.

The condition of the female wasp differs widely from that of the female bee : The latter, when she leads from

* Reaumur, Tom. VI. Mem. vi.

the parent hive a young colony, and founds a new empire, is essentially a queen; for she is more implicitly obeyed than the best of monarchs, by the most loyal of his lieges. The female wasp, as her station is more laborious, so her genius seems more enterprising. Unaided by any of her kind, she lays, in the beginning of every season, the foundation of a new edifice, which is destined to be the birth place of many thousands of her species. She constructs the first cells, to which she commits the earliest of her eggs, which in time become mule wasps, the most active and laborious of the whole race; and by these she is assisted in completing the rest of the work.

The male wasps are not so slothful as the male bee; they discharge several duties in the interior parts of the hive; but in the art of building, either the cells or the external covering, they are altogether unskilled. This falls to be executed by the mules, who carry it on with amazing dispatch. They collect together the small fibres of half rotten wood, which they moisten with a glutinous substance, and bake up into that paper of which all their work is formed.

The aerial wasp constructs small nests of about the size of an orange, which it attaches to the branch of a tree. This compact little edifice is exposed to the weather, but is rendered impenetrable to rain, by a number of leaves which are placed round it, exactly resembling an inverted rose. A particular species in the neighbourhood of *Cayenne*, construct a large oblong box, about twelve or fifteen inches long, of fine parchment, which is also pendent from the branch of a tree; there the combs fabricated of the same substance, are ranged horizontally, in different stories, one above the other; each having a
round

round hole in the centre, by which the wasps are enabled to ascend or descend to different flats of their building *.

In the mean time, while these operations are carrying on by the joint labours of the hive, the mother wasp continues to lay till she has produced fifteen or sixteen thousand neuters or mules, and about five or six hundred males and females: The commonwealth day by day increases in numbers, and enjoys peace. Towards the month of *October*, provisions begin to grow scarce, and a new scene ensues: This hitherto amicable tribe seems then fired with mutual rage; and the whole edifice presents one scene of massacre. The neuters and males tear from their cradles the eggs, the larvæ, and new born insects, with undistinguishing fury. They next fight one against another. Hopes of the state, solicitude for posterity, or love to their native place, now no longer exist; the whole commonwealth is shaken to the foundation. Rains and frosts ensue; the citizens are seized with disease and languor; and happily for the other insects, and the fruit gardens, almost the whole die. Some few females escape from the disasters of civil war, and the severity of winter, and again in the ensuing spring become the founders of new empires, which are again to be overturned †.

* Reaumur, ubi supra.

† Barbut's Gen. Insect. p. 262.

GENUS VIII.—*Apis*. *The Bee*.

WE are now come to a tribe of the most useful of insects, whose history has been the subject of many volumes. Almost every writer on entymology has made the manners and economy of these animals a considerable part of his work; and many authors have treated of them, who have entered into no other department of natural history *. Several of these, catching that enthusiasm which is natural in contemplating creatures whose instincts are truly wonderful, seem to set no bounds to the eulogies they have lavished upon them. If you believe them, there is hardly any sort of intelligence or moral virtue, which bees do not possess; and the whole of their manners are such as afford us but too just causes of blushing at our own. The celebrated *Reaumur*, in detailing the economy of these animals, an object to which he applied himself with a perseverance superior to all mankind, has abstracted much of the marvellous from their history; but in return, he has enlarged it with many facts and observations formerly unknown, and which succeeding experiments have seldom contradicted: The following brief account of these insects, in general, rests upon his authority.

There

* Among the most judicious naturalists who have written upon this subject, we may rank the following, viz. *Mouffet*, *Marian*, *Aldrovandus*, *Johnston*, *Charleton*, *Ray*, *Dale*, and *Reaumur*.

Plate X.



GEN. VIII.
APES.



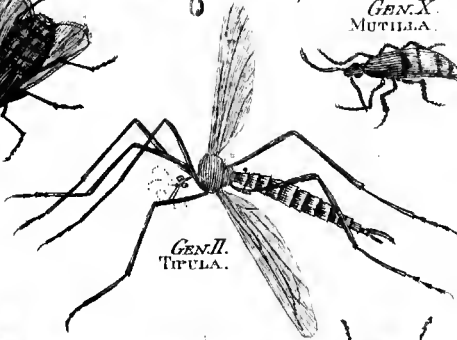
ORDER VI.
GEN. I.
OESTRUS



GEN. IX.
FORMICA.



GEN. X.
MUTILLA.



GEN. II.
TIPULA.



GEN. VI.
EMPIS.



GEN. V.
CULEX.



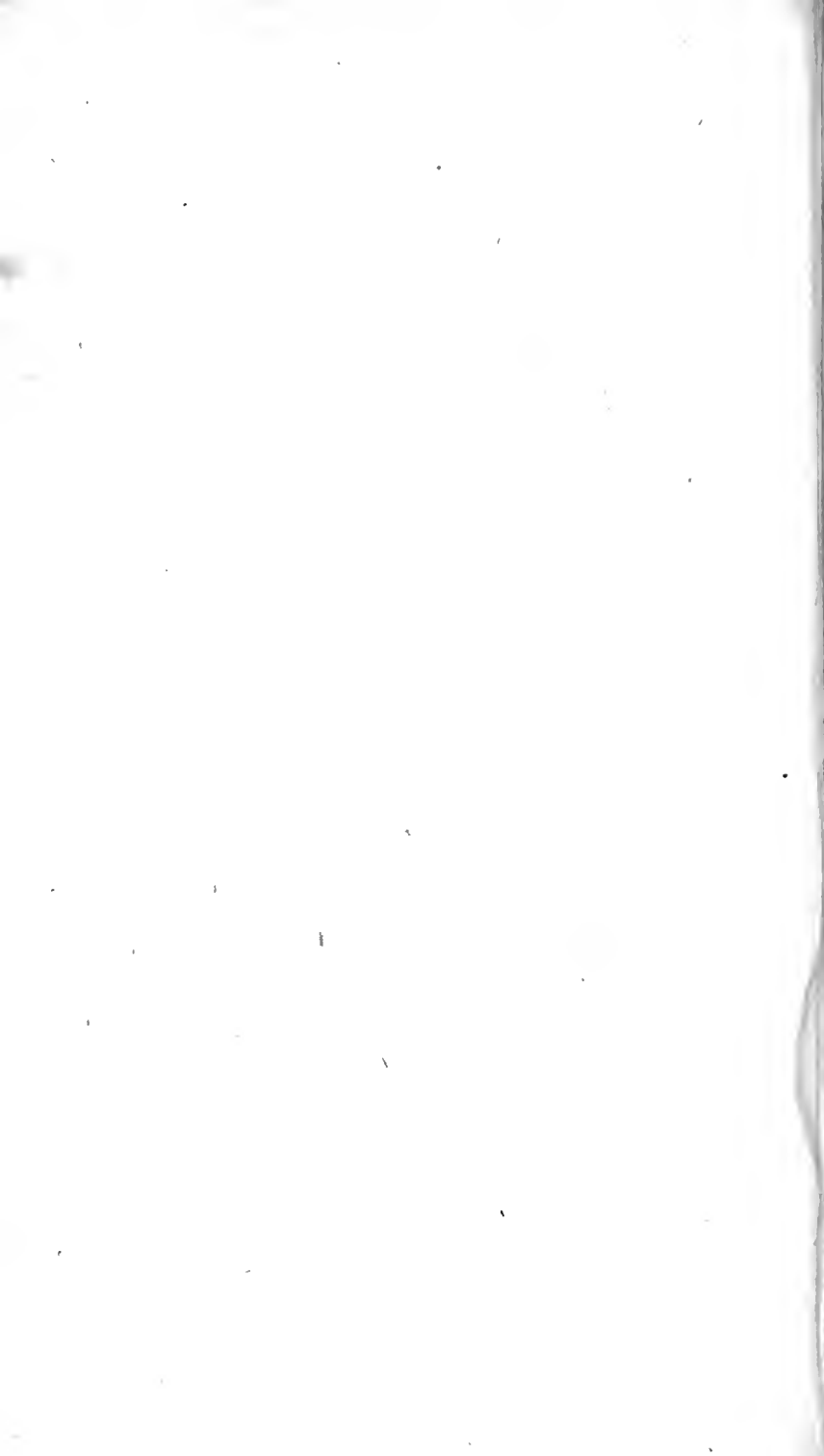
GEN. III.
MUSCA.



GEN. VII.
CONOPS.



GEN. IV.
TABINUS.



There are, at certain seasons of the year, three kinds of bees in every hive; the males, the females, and the bees without sex. The latter every person is acquainted with; their number is beyond comparison greater than that of the other two kinds. Nature seems to have destined them solely for the purpose of labour; and the whole drudgery of the hive lies upon them; hence they have properly been termed Working Bees.

It is only during one or two months of the summer, when the hive is most crowded, that males are found in it; and even then, they do not amount to a tenth part of the whole: They are of superior size, and distinguishable by the characters afterwards to be noticed. During the whole course of the season, except a few days, there is only a single female to be discovered in the most numerous hive. Her fecundity, however, is so prodigious, that she is soon capable of multiplying her family to such a degree, that the hive can no longer contain it. To her the whole swarm, amounting from twenty to forty thousand, owe their birth. Her residence is generally in the interior apartments of the lodging; when she shews herself, she is readily known from her size, being longer than even the male bees, but inferior in thickness. It is this female whom the ancients dignified with the title of King of the bees, and whom, with the utmost propriety, they might have denominated their Queen. From a number of well attested experiments and observations, it appears that the common bees pay her more than respect. They continually endeavour to be useful to her; and by carressing her, and offering her honey, they seem to anticipate her wants. Her life is more precious than any
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of the rest ; wherever she goes, therefore, she is encircled by a guard, that continually pays court to her *.

It is not without cause that this sedulous attention is paid to the mother bee ; she is the soul of all their operations. If a hive is deprived of her, however numerous, it will undertake no labour ; and the individuals will hardly give themselves the trouble of collecting their daily subsistence. A swarm that was busy from morning to night constructing cells and collecting wax, immediately upon this accident seems to forget that the flowers contain their food ; they scarcely stir from the hive, construct no new cells, nor even finish such as were begun. The moment she is restored, their wonted spirit and activity is resumed by the whole swarm : Not only do the working bees resume their labours when the queen is restored, but they ply them with an assiduity proportioned to her fertility. Although they contribute nothing themselves to the generation of the young bees, the Author of Nature seems to have given them the same affection, and to have interested them in their welfare, as much as if they had been their real parents.

The external parts of bees are happily accommodated by their structure, to the delicate operations they are destined to perform. Each of them is furnished with a trunk or proboscis †, commonly folded up, but capable of being extended at pleasure : It is with this instrument that they collect their food ; not by pumping or sucking, but by licking it from the nectaria of flowers ; vessels that have been but lately discovered by the botanists, but
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* Reaumur, Tome V. Mem. v.

† This small instrument is said to consist of no less than twenty different parts, perceivable by the microscope. Reaumur

with which the bees have been well acquainted from time immemorial*.

The teeth with which these insects are provided, serve another purpose equally important; they are the instruments by which they fashion and give a proper consistency to the wax. That valuable commodity is not found in a perfect state upon the flowers, as many have imagined; it is there scattered upon the surface in the form of a fine powder or dust, and swept off by the hairy legs of the bee, and deposited in a hollow part of each thigh, prepared for its reception. After being carried in that form into the hive, it is all ate up by the bee; and by the action of the stomach is brought into the state of genuine wax. From the stomach, the working bee brings it back in small parcels to the mouth, like a ruminating animal; and, by chewing it there, fashions it into pieces proper for the construction of the cell, to which it is applied, and afterwards polished as the situation requires.

That small scaly spine, commonly termed the sting of the bee, is only the case of two needles or darts, extremely fine, and each dentated towards the point. The wounds made by these slender arms would be little to be apprehended, were their points not impoisoned by a small drop of acrid liquor. This liquor, which, when tasted, burns the tongue, is conveyed along a small canal to the case of the sting, on the tip of which it appears in small drops, when the bee intends to make use of her offensive weapons. However disagreeable this instrument may sometimes prove to us, it is absolutely necessary to the bee, surrounded as that animal continually is with many enemies,

* The diligence of the bee is often alluded to in ancient poetry.

Apis mantinæ more modoq. grata carpentis thyma. Hor.

enemies, whose hostilities are constantly provoked by the honey and wax.

The sting of the bee is also used for another purpose, the propriety of which we are not so well able to vindicate. At a certain time, they are busy from morning to night in no other employment than massacring their associates. The males, it seems, after the female is fecundated, become useless, and even offensive to the rest of the hive. The working bees, who had formerly been their nurses, and hitherto had lived with them in the best understanding, all at once break loose upon them with unrelenting fury, and in two or three days destroy the whole in one general carnage †.

Of the reasons alleged by the working bees for this massacre, we are altogether ignorant; we know not upon what claim their power of life and death over the males is founded, farther than that nature seems to have granted such a right, by giving them power to exercise it. These, however, are not the only combats in which the bees are engaged: The working bees of the same hive often quarrel, and challenge each other to battle. Long do they struggle in defence and attack, like two skilful pugilists, the one endeavouring to find a place in the scaly body of his adversary into which he may thrust his sting, and the other as studiously warding off the blow. The first wound that takes place puts an end to the engagement; and the victorious bee walks off, leaving his adversary to expire in the dust. Sometimes three or four attack a single bee, without any design upon his life, but with a view to force him to disgorge his honey; and
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† Virgil was acquainted with this peculiarity. *Fucos a prescripibus argent ignavum pecus.* *Æn. Lib. ii.*

as soon as they have succeeded, they lick it up, allowing the former proprietor to walk away.

Battles far more fatal and general are occasioned when a neighbouring swarm, from poverty, or a principle of injustice, invade a hive already occupied. Scarcely have they entered the walls of the city, when a bloody engagement ensues: Those who have the right of possession oppose their invaders with all their forces, and with undaunted courage; not a minute passes that you do not observe a victorious bee dragging to the door of the hive a dead adversary, or one who is yet struggling in all the agonies of death. These engagements do not close but with the day; and before victory declares for either party, they often cost thousands their lives; for very often the one who has slung its opponent leaves its weapon in the wound, an accident which proves fatal to itself.

Insects of their own species are far from being the only enemies which the bees have to fear; worms, wasps, hornets, and insects of different kinds, never fail to make their way into the hive, wherever any rent or crevice is left open. When attacked by these robbers, they perish in the unequal combat; and when dead, their bodies are ripped up, in order to extract from them the honey they contain. Apprised of the fatal consequences of admitting them into the hive, the bees carefully fill up every chink and crevice, not with wax, but with the glutinous matter that exudes from certain trees, a substance still more tenacious. When a bee enters the hive loaded with a quantity of this stuff, it is met by others, who take small particles of it, and apply it to the sides of the part to be stopped up, till they are entirely closed.

A swarm of bees, however numerous, as we have already seen, all owe their birth to a single female. This

queen, which *Virgil*, and the other writers of antiquity, have charged with all the cares of government, is indeed busily occupied, but in functions of a different kind ; and these are, the production of a vast number of eggs, which she continues to drop, one after another, into the empty cells, during a considerable part of the summer. This animal, which is so amazingly productive, on being opened, has been found to contain upwards of five thousand eggs, all of a size sufficient to be perceptible. If we make allowance for those that were already dropped, and many more not yet formed so as to become perceptible, we shall no longer deem it incredible, that this animal should in one season become the mother of so many thousands. The most numerous hive is far inferior to the number of spawn that have been taken from the belly of a small fish. During the whole time that the female goes from cell to cell depositing her eggs, she is accompanied by the working bees, who tend her with the most officious care. And as the males and females are produced by her of a superior size to the rest, the working bees, as if apprised of the circumstance, construct a few cells larger than the rest ; and what is still more remarkable, the female herself knows which of the embryos are to become of her own sex, and accordingly deposits them in cells of a suitable capacity. The cell which is to contain the future queen bee is of a structure different from all the rest ; and in building it, the labourers abandon the hexagonal shape which is best adapted to the saving of labour, and of wax ; nothing, in this instance, seems to cost them too dear: The cradle of their future queen consumes as much as a hundred or a hundred and fifty of the ordinary cells.

From the great number of males in each hive to a single female, the ancients were induced to believe, that fecundation among these insects was not accomplished by any act of copulation, but that it was performed by a vivifying liquor shed upon the ova in the cells : But this opinion was overthrown, as soon as it was observed, that for nine or ten months in the year there was no male in the hive. *Swammerdam*, who could not observe that in these animals there were any parts of generation †, therefore supposed, that the female was impregnated solely by the effluvia of the male bees. The observations made by *Reaumur* have removed those difficulties with which this part of the history of bees seemed to be attended. The female, who is surrounded by so many males, instead of being fatigued and persecuted by their importunities, is obliged to caress and inflame the passions of these drones, who are the most cold and indifferent of all their sex. She mounts upon their backs, and pushes her gallantry to what may be deemed indecency ; at length her allurements produce the desired effect, and copulation is performed.

The female thus impregnated proceeds to lay her eggs, which are round and oblong, rather thicker at the one end than the other. Each is deposited in a separate cell, except upon some occasions, when the industry of the working bees has not been sufficient for the fertility of the mother : She then lays two or three in a single cell ; the supernumeraries being afterwards carried away and placed by themselves, as soon as new cells are provided. The single egg which remains is fastened to the bottom of the cell by the small end, the only part which seems

† *Biblia Naturæ.*

to touch it. In a single day or two after being placed there, it produces a worm, which the working bees take care to supply with suitable food, consisting of a whitish liquor, which serves it at once for subsistence and a bed; for it lies upon it, folded up like a ring. In the space of six or seven days more, the whole of its growth is completed; and the bees, who know the time at which it no longer needs to be supplied with food, cease to carry it any more. The last office which they render it, is closing up the mouth of the cell, which is done with wax.

In the mean time, the young animal within, which hitherto was almost entirely inactive, begins to spin silk, and line the inside of its habitation, as a preparative to its entering into the chrysalis state, in which it for a while remains. Thus, in the space of about three weeks after it was first dropped into the cell, the young bee is ready to make its appearance as a winged animal. The first employment, after it has arrived at that period, is to gnaw off the wax with which the mouth of its cell had been stopped up. On its first issuing from the cell, the whole body is wet with the humid substance of the cell; but the affectionate bees flock around, and with their trunks assist it in wiping off the moisture. The wings grow dry, and the limbs firm; and in the course of the same day, it issues forth with the labourers to collect wax and honey, and thereby to make returns to the society for the care with which it has been reared.

Thus, after the commencement of summer, the number of bees daily continues to increase, till, by the month of *June*, they have become so numerous, that the same hive can no longer contain them. The only measure which
then

then remains to be adopted, is, to divide ; and in an instant, a large colony prepares to abandon for ever the place of their nativity, and to follow a young queen in forming a new establishment for themselves.

It is not merely the number of bees in a hive that determines them to swarm ; that event depends on the young female, who must not only be sufficiently strong to lead the colony, but must also be impregnated ; for upon that circumstance depends the whole hopes of the future progeny : But no sooner do all these predisposing circumstances concur in a hive, than it prepares immediately for colonisation. In the evening before that eventful period, indication of their intentions is given, by an unusual noise and hurry within the hive. All the morning of next day passes without hardly a single bee going to collect honey. Those who are to leave the hive are preparing to take their departure ; while those that remain behind defer their operations, till their companions, by their leaving them, have afforded sufficient room.

It is in the great enterprise of colonisation that the influence of the queen bee is most clearly seen : Wherever she alights, there the whole swarm take up their abode, and all cling around her body. If she is removed, they all fly in quest of her : if put into a hive where she has not been placed, they either forsake it or die. Hence the art of those persons is explained, who go about shewing bees, making them alight on different parts of their body, and follow them for any length of time. They have possession of the queen bee ; and by that means can influence all their movements.

When a swarm thus migrates from the parent hive, it frequently happens that more than one female accompa-
nies

nies it : The prosperity, however, of the new colony requires that there should be but one ; one only is accordingly preserved. In a single day, all the rest are put to death ; and it is found that the one which is spared is the best entitled to reign, because she is most fertile, or nearest her period of giving a new progeny to the society. The young females in the old hive, if any remain there, share not a more happy destiny ; all the supernumeraries, like those in the swarm, are put to death.

We have already remarked that the bees have many enemies ; and in some seasons, we are told, they are liable to fatal diseases : but of all their destroyers man is the greatest, from that barbarous avidity which gives rise to the practice of killing every hive that has collected a sufficient quantity of honey *. In the winter season, cold or hunger are the scourges which often destroy such as our rapacity has spared. In sheltering them from the one of these evils, we often expose them to the other. Too great a degree of cold makes them perish † : If placed in a situation too warm, they are awakened from their torpid state, and devour their food with an appetite which soon brings on a famine. Experience is the only guide that can prevent the bee master from falling into these extremes.

In *Egypt* and in *Greece*, where the collection of honey was deemed a trade of importance, the hives were regularly removed to a different part of the country, when the flowers had faded in another. It was for this purpose,

* Reaumur advises the French government to inflict an arbitrary punishment on all who *smoked* bees. Tome V. p. 666.

† The ancients were of opinion, that bees benumbed with cold might be restored by hot ashes. Vid. Columella & Varo.

pose, that boats flored with hives were set afloat on the *Nile*, gradually bringing the insects within the reach of fresh food as the old was exhausted. A similar method was some time ago practised in *France* by a person who had six or seven hundred hives in his possession †.

Such are the outlines of the history of the domestic bee, an insect to which we are indebted for two material articles of our enjoyment, wax and honey. The genus of insects to which it belongs is distinguished into fifty-five different species, all differing in their manners, as well as their external form. Their common characters, in which they all agree, are, a mouth furnished with jaws and a proboscis, inclining towards the body, and inclosed in a sheath; wings which are extended, and without folds; three stigmata on the head, and stings carried in the other extremity by neuters.

Apis mellifica, the domestic neuter bee. This animal is so generally known, that no description of its parts is necessary.

Apis mas, the *male* bee. This species has no sting, nor are its feet or rostrum fitted for the collection of wax or honey: it is larger than the common working bee: it hovers upon flowers; and its only office is impregnating the female.

Apis regina, the queen bee. This animal is easily distinguished by her great length of body, and the shortness of her wings, which she never uses but when employed in leading out a young swarm.

Apis muscorum, the humming bee ‡. The three former insects, as they breed together, may all be deemed of the

† Reaumur, Tome V. Pref. p. 40.

‡ Syst. Nat. Ord. V. Gen. viii. sp. 46.

the same species : this is larger in size, and more variegated in colour : It constructs its nest in a hasty manner, of piles of moss, collected in the meadows. The vaulted roof proves a security against rain, and the flooring of moss below preserves the nest from damp.

The female bee collects unwrought wax, and a species of honey, in a few cells coarsely constructed, and there she lays her eggs ; the hive gradually increasing, till it contain fifty or sixty bees, which, by the frosts and rains of winter, are almost wholly destroyed. A few impregnated females survive the severity of the season, and build new nests in the spring, which are to be the cradles of new hives. Field mice, hornets, and ants, often plunder from these industrious animals the little vessels of honey which they had laid up for the winter†.

† Barbut, p. 262.

GENUS IX.—*Formica. The Ant.*

THE characters of this remarkable tribe are, a small erect scale between the thorax and abdomen; truncated or broken antennæ, having their first articulation longer than the rest; the females and neuters armed with a sting, which is concealed in the abdomen. The males and females have wings, while the neuters are apterous*.

In the System of Nature, there are enumerated eighteen different species of the ant; of these, the largest is the hippomyrmex, or horse ant, which is found in the hollow trunks of rotten trees. The head is black, and the thorax ferruginous; the feet are of the same colour, while the abdomen is brown: The erect scale between that part and the thorax, is oval, entire, pointed, and round†. The other animals of this genus most common, are,

The larger and smaller red ants. These are found in woods, or under heaps of dry earth, and are the most laborious and industrious of the whole insect tribe: under these characters they are frequently alluded to by almost every writer of antiquity.

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* Systema Naturæ, Ord. V. Gen. ix.

† Vide Rai Inf. p. 79.

The ants nest is in fact a small well regulated commonwealth, resembling in many respects that of the bees. Like them, they are continually employed in labour, and have a large proportion of the citizens neuters, whose sole employment, like that of the working bees, is collecting food for the society. The males and females have wings, and seem destined for higher enjoyments, as well as more noble occupations. Their operations are all conducted in peace, union, and good understanding; though, if we are to credit the wise man as a naturalist, *they have no guide, overseer, or ruler* *.

When they have chosen their ground for forming an establishment, which is generally some dry and sunny exposure, all are employed in digging their retreat, to the depth of about a foot or more: They seem to take neither rest nor food till it is completed; and to prevent disorder or confusion, their police assigns to every one his task. While one loosens the earth, another carries it away, and is met by others returning for a new load.

Within this hollow cave, when formed, these insects all live in society, and shelter themselves from the severity of winter. Even after the edifice is constructed, there is not a day allotted for rest, so long as the weather will permit them to go abroad. They are continually wandering about in quest of food, and carry all day each his burden into the nest. Should one chance to meet with a booty which is too large for him to remove, he is soon perceived by the rest, who come in legions to gnaw it into smaller pieces, or to assist in rolling along the unwieldy

* Vide Solomon, Prov. chap. vi. 9. Go to the ant thou sluggard, consider her ways, and be wise; which having no guide, overseer, or ruler, provideth her meat in the summer, &c.

weildy mafs. Corn and feeds form an acceptable food ; but as they are alfo carnivorous, they devour frogs and lizards when delivered over to them, or unable to defend themfelves.

Later naturalifts have afferted, that all the food collected by the ants during the day, is depofited in the common hall, and devoured every evening, or diftributed to the young ; and that, in winter, they pafs into a torpid and benumbed ftate, in which they are incapable of taking any food *. This, however, is contradicted by the voice of all antiquity. *Horace* recommends its example to the mifer, as being noted for liberally enjoying during winter, whatever had been amaffed by its own induftry in the mild feafon †.

We confeß our incapacity to decide this matter ; but having been unable, after all our recherches, to find out the ant's winter ftore, we are rather inclined to think that in that feafon they either ufe none, or are fatisfied with what they can occasionally procure.

The eggs of thefe infefts are depofited pretty early in the fpring ; and in order to provide the neceffary warmth for their young, the old ants are feen carrying them out to expofe them to the heat of the fun. The worms go into chryfalids, and are metamorphofed in their own fkin. When about to iffue forth into new life, it tears this white covering, and comes forth a perfect ant. The ants

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copulate

* Barbut, and many other naturalifts.

† ————— Sicut

Parvula, nam exemplo eft, magni formica laboris

Ore trahit quodcunque poteft, atque addit acervo

Haud ignara, ac non incauta futuri.

Quæ, fimul inverfum contriftat aquarius annum

Non ufquam prorepat, & illis utitur ante,

Quæfitis fapiens.

Lib. I. Sat. i. l. 33.

copulate in the air ; and the females, who are the smallest of the race, seldom repair to the common habitation : What is their destiny, whether they die by the severity of the winter, or fall a sacrifice, like the bees, to the merciless fury of the labouring ants, is not ascertained *.

We have already had occasion to remark the fondness of these insects for the saccharine liquor that exudes from the plant louse : it is in quest of that food that they are frequently seen on plants, in the company of these insects. In *Switzerland*, however, they are transported to trees for a different purpose ; the destruction of caterpillars, and other vermin. A bag filled with ants is fastened to a tree, with a small hole purposely left open for them to creep out ; they spread along the tree, and are prevented from leaving it, by a quantity of pitch with which the stem is covered. Rather than die by famine, they go in pursuit of the caterpillars among the leaves, and devour them.

* Barbut's Gen. Insect. p. 289.

GENUS X.—*Mutilla*.

A FEW only of this tribe are winged ; in those that are provided with these instruments, they are resplendent like pearl, and laid horizontally upon their backs. The antennæ are broken, and have the first articulation longer than the rest ; the body is covered with down ; the thorax is obtuse at the base ; and the sting is concealed within the abdomen*.

The common residence of the mutillæ is upon the ground, below moss, especially where there is a hollow space between the moss and the earth. They are gregarious, and when disturbed in their retreats, they make their escape by running very swiftly. The mutillæ, for the greatest part, are inhabitants of foreign climes : that most frequently seen in *Britain* is,

The mutilla *Europea*. The thorax of this insect is a deep yellow, mingled with black velvety down ; the prevailing colour of the abdomen is black, but is adorned with two, and sometimes a greater number of yellowish white bands ; the antennæ are black, and bending ; the legs of the same colour, and hairy ; the eyes are of a beautiful pearl white, shining from a head of a coal black.

* Syst. Nat. p. 966.

ORDER VI.—*Depterous Insects.*

THIS order comprehends all the numerous races of flies, tipulæ and gnats, which are characterised by having only two wings: Below each of these there is placed a halter or poiser, which is terminated by a knob, and has its base concealed under a little scale*.

* Syst. Nat. Ord. VI.

GENUS I.—*Oestrus*. *The Gad Fly*.

THIS insect has no mouth, nor any visible proboscis : in place of these are three small points. Upon the head, there are three stemmata, or small eyes ; the antennæ are setaceous, and commonly short.

Oester bovinus, the ox gad fly. This large species penetrates through the skin of cattle, and deposits its eggs there. It has no mouth, black eyes, a yellow thorax, and pale-coloured feet ; the wings are membranous, and interspersed with small black spots *.

Oestrus rangiferus. This species frequents the backs of rein-deer, especially those that are tamed, and deposits its eggs there ; it is twice the size of the former, and called by the *Laplanders* *curbma* †. The wings are without spots, and the body is covered with a yellowish down.

Oestrus ovis, lodges in the noses of ruminating animals, particularly of the sheep, and is therefore called by the *Swedes*, *noosmålken* ‡. To this tribe is also added the *oestrus hæmorrhoidalis*, which makes its way into the anus of the horse, in order to deposit its young §.

In the economy of nature, there is nothing appears more surprising than that instinct by which certain animals are directed to deposit their young in the only place

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where

* Rai Inf. p. 271, & Derham's Physico Theol. l. 8. c. 6.

† Fauna Suec. N. 1025.

‡ Reaumur, Tome IV.

§ Voyage de Gotlande, 277.

where they can find suitable food, and necessary warmth. The young of certain flies are only capable of subsisting below ground, and of deriving food from a certain flower, the narcissus. The mothers of these deposit their eggs in the roots of that plant. Other flies enter the anus of a horse, because their young are only capable of subsisting in the entrails of that animal, where they remain till they are about to be metamorphosed, and are then ejected with the dung *. Others are provided with a curious instrument, by which they perforate the hides of cattle; and in each hole thus made, they deposit an egg.

Each of these worms, after being hatched, finds itself surrounded with its proper food, among which it grows; and the cell increases in size at the same time, till it sometimes reaches the bulk of an egg. The wound becomes filled with purulent matter; and the opening from which it runs serves to supply the insect with air. After the worm has grown there to its full size, it needs a place more dry, and of less heat, for its metamorphosis; it then drops from the orifice of the wound, and betakes itself to some hole, or other retreat, where it is transformed.

An instinct as singular as any of the former is that by which some flies are directed to the nose of a sheep, a goat, or a deer, to lay its eggs. It is in the frontal sinus of these large animals, that the worms produced by these eggs are destined to search for the only food capable of supporting them. Some of these worms, after being ejected from this strange nidus, become covered with a hard shell, in which their last change is completed. Nature, which provides for every exigence, has furnished
this

* Reaumur, Tome IV. Mem. xii.

this shell, which is of a texture too hard for the animal to break, with a valve at one end, fastened only by a small thread. At the first effort for freedom which the young æstrus makes, the door gives way, the prison opens, and the insect flies to those woods and meadows that were frequented by its ancestors*.

* Reaumur, ubi supra.

GENUS II.—*Tipula*. *The Crane Fly*.

IN this tribe, the mouth is a prolongation of the head ; the proboscis is short, and bent inwards ; the upper jaw being arched : All the different species, which are no less than fifty-eight, have two palpi, which are incurvated, and longer than the head *. The whole genus is readily distinguished by the enormous length of their legs, by which they are enabled to walk among the grass, as men are assisted by stilts in passing through marshy ground.

The *tipula maxima* of *Ray* is one of the largest seen in this country : The wings are variegated with brown and white ; the body and abdomen are of an ash-coloured brown †.

Tipula crocata, the saffron crane fly. This elegant species has the thorax and scapuli of black hue ; the belly saffron : the wings are marked each with a smooth resplendent spot of a brown colour ; the rest of the wings are yellow, and the annuli of the abdomen are distinguished by alternate bands of yellow and black ‡.

The ash-coloured tipula is mentioned by *Goedart* §, *Lewenboeck* ¶, and *Reaumur* ||. The whole body is of an
ash-

* Syst. Nat. p. 970.

† Rai. Insect. p. 72. No. 2.

‡ Ades. d'Upsal, 1736, p. 30.

§ Part II. p. 165.

¶ Epist. 1693, Dec. 20.

|| Tome IV.

ash-colour; the wings of a water-colour, having a brown longitudinal bar upon their exterior parts. It is found among garden plants.

The larger tipulæ are known by the name of Sempstresses; the small by that of Culiciform. The latter, in fine summer evenings, flutter about the sides of rivers in legions. The shrill noise which they make with their wings is not very discernible unless they are very near. They are sometimes taken for gnats; but they want their proboscis, and their manners are far more inoffensive.

The tipulæ, before they become inhabitants of the air, creep in the form of grubs: Those of the larger kinds dwell in holes of decayed willows, where they change into chrysalids. In that state, they have the power of breathing through small curved holes. The larvæ and chrysalids of the smaller tipulæ are generally found in water; they are extremely various both in colour and form: Some have cylindrical tubes through which they breathe, even while considerably immersed in water, by stretching their points to the surface*. They swim with great nimbleness, but seldom forsake the hole they have dug in the bank of the river. There are others of these animals that spin a silken coat, that receives part of their long body before their transformation. After these operations are performed, all of them renounce their reptile and aquatic life, having received instruments of flight from the hands of nature. Their frame is then so weak, that a touch is enough to crush them. They are sometimes of a beautiful green, sometimes coal black; but the most remarkable are those whose fore legs, though extremely long, do not touch the ground, but move in the

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air

* Reaumur, Tom. V. Mem. i.

air like antennæ. In this their last and most perfect state, the tipulæ being provided with proper organs, apply themselves to the important work of propagation; and having provided for another generation, their short existence draws to a close *.

* Barbut, Gen. Inf. p. 294.

GENUS III. *Musca. The Fly.*

THIS numerous tribe is characterised by that soft and fleshy proboscis which forms the mouth, and by being destitute of palpi. There are about an hundred and thirty different species of flies already known to naturalists, who have divided them into two grand sections; those with filiated and simple antennæ, and those whose antennæ are furnished with a lateral hair or feather*.

Nothing so clearly demonstrates the imperfection of the science of entymology as the small number of flies that have been hitherto described by naturalists. The System of Nature in its last state of enlargement, was supposed to contain the most accurate and complete enumeration of insects that has yet been published: *Mr. Harris*, however, in his Exposition of the *English* insects, describes a greater number of flies indigenous in this country, than the *Swedish* naturalist had discovered on the whole face of the globe. *England* is at the same time far from being the most productive country of these animals. In *Spain*, they were formerly so numerous, that the fly-catcher, we are told, was not only a profession, but a number of men were commissioned by government to give chase to these troublesome invaders. In all hot climates they multiply to a degree almost intolerable,
and

* Syst. Nat. Ord. VI. Gen. iii.

and are extremely destructive to butcher meat, and other kinds of provision.

Next to the number of flies, their variety claims our attention. The different species are extremely diversified in their external form, their structure, their organization, their metamorphosis, their manner of propagating their species, and in providing for their posterity. A full explanation of these different parts of their economy, would require a large volume, and would constitute a narrative to many readers not uninteresting. Such an undertaking, however, is incompatible with the limits prescribed to our work.

Some of these insects have trunks instead of a mouth ; others have that organ armed with teeth ; and many have both a mouth and a trunk. The proboscis of flies is a machine contrived for pumping the blood from the vessels of large animals, and the nectar from the petula of flowers ; and the science of hydraulics has not enabled men to construct machines more complicated, more exactly arranged, or better adapted to these purposes. Some of them possess considerable firmness and solidity, those especially that are destined to pierce the skins of cattle. In order to see them at work, all that is necessary is to expose a syrup to attract them, and to take up a lens for their inspection.

Each eye of the fly contains in it an assemblage of a great number of small ones, which probably have the effect of multiplying the surrounding objects, and creating representations of them, which the experience of the insect corrects *. From the eye, if you pass along and survey

* Reaumur, Tome IV. Mem. vi.

vey the body, you find it provided with the organs of respiration. Four small stigmata, for this purpose, are found upon the thorax, and a greater number dispersed over the annuli of the abdomen. The covering of the different parts of the abdomen are scaly, and do not consist all of one piece, but admit of the contraction and dilatation of that part, according to the circumstances of the animal. Each of the feet terminates in a small bunch of *setæ*, resembling a brush.

The interior organization of this genus, when examined with a proper apparatus, presents two pulmonary sacs of a white colour, arranged longitudinally along the body. As the bodies of some species are diaphanous, the action of the heart may also be discerned, as well as the liquor it contains, continually driven along the great artery leading to it, and returning by the same course*. During their larva state, the flies in general go through a greater variety of metamorphoses than even the silk or butterfly worms: During their progress from the vermicular to the chrysalis state, they pass through an intermediate change, unexperienced by other insects. From the shortness of their lives, all these vicissitudes must rapidly succeed each other: this circumstance, however, does not prevent many species from constructing a coque for their last metamorphosis, of a curious fabric. The greater part of these coques are of silk, with a mixture of other materials; those, indeed, most common with us, serve themselves with their own skin, which becomes an incrustated covering to protect them during their dormant and aurelia state.

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* Idem, ubi supra.

When the different members have acquired sufficient firmness, the fly is ready to burst from its shell in its winged form. The covering of the chrysalis, especially of those who are metamorphosed in their own skin, seem to prove, by their hardness, an effectual bar to that event. About the time, however, of its change, the head of the fly is capable of being swollen and dilated in an unusual manner; and it is by means of this dilatation that the fly bursts its covering, and opens a passage for its escape.

The food of flies is as various as their different kinds; some being supported wholly by vegetable substances, while others are carnivorous; and among the latter there are some who only devour flesh in a state of putrefaction. Dung, and vegetables in a similar state, are the favourite meals of others. In the history of the æstrus, we have already noticed that instinct by which the females are directed to deposit their eggs within reach of food proper for each species †.

The female flies are all fecundated by copulation; an act in which the most incurious observer must have frequently seen them engaged. The observations of *Reaumur* seem to prove, that the females of some kinds take that part in the act of fecundation which is usually performed by the male in other animals; and that it is her extremity which penetrates into the body of the male. The far greater part of insects are oviparous; some, however, belonging to this genus bring forth living young: But what appears most unaccountable is, that some apparently of the same species are viviparous, while the rest lay

† Page 97.

lay eggs; a circumstance that shews the futility of our attempts to arrange them. Some of the viviparous flies possess a degree of fecundity that must appear altogether incredible to those who have not been versant in the study of insects. Some of them have been found to contain in their body no less than twenty thousand living animals at one time *.

Musca domestica, the house fly. The thorax of this species is brown, having upon it four occult dark lines; the abdomen is of an orange brown, with a few spots of black. This fly seldom makes its appearance before the month of July †.

Musca vespa similis, the wasp fly, entirely resembles the animal whose name it bears; the head is lemon coloured; the antennæ are brown; the thorax and abdomen are black, the latter marked with transverse bands of yellow.

Musca pellucens; the transparent fly. The thorax is black, partially covered with a few brown hairs, and having the point sometimes yellow: The abdomen has its under part black, the upper white, and is transparent both above and below ‡.

* Reaumur, Tome IV. Mem. x.

† Harris's Inf. p. 142.

‡ Barbut's Gen. Inf. p. 301.

GENUS IV.—*Tabanus*. *The Horse Fly, or Flogg.*

THE insects of this genus are the great tormentors of horses and black cattle; their proboscis is shaped like a sting; and with it this fly sucks out the blood of larger animals, which is its favourite food. Notwithstanding its diminutive size, and apparent insignificance, it engages with the bull, and at once enjoys the honours and the fruits of victory: For in spite of all his efforts, it gluts itself with his blood. Cattle, either when intended for fattening or for milk, are greatly harrassed and injured by these insects in the hot months; and whoever would prevent their mischief, would certainly be entitled to those honours and rewards that are due to the discoverers of useful improvements in rural economy.

Tabanus bovinus, the ox fly. In this species the head is grey; but the eyes, which occupy the greater part of it, are brown. The thorax is of a grey colour, and the abdomen yellow.

Tabanus niger, the dark brown. This species varies considerably in colour; some describe it as approaching to black; others grey*, and some dark brown. The wings are grey; the feet brown; and the segments of the abdomen are black, with a clay coloured edging upon each. This insect is a great tormentor of the rein deer in *Lapland*†.

* *Fauna Swedica*, Ord. VI. Gen. vii. † *Regne Animale*, p. 198.

GENUS V.—*Culex*. The Gnat.

THE insects of this tribe are extremely numerous, and universally known, by the uneasiness they occasion. The *Swedish* naturalist only enumerates seven species; but there are some places in *America* where a number of non-descripts might certainly be found. The genus is discriminated by the mouth, which consists of a flexible sheath, inclosing bristles pointed like flings. The antennæ of the males are filiform, those of the females feathered*.

In their larva state, these animals are aquatic: During the greater part of summer, all stagnated waters are full of their small worms, hanging with their heads downwards, while their hinder parts reach the surface of the water. In this state, the stigmata, or organs of respiration, are situated near the anus; and hence the reason why these parts are frequently seen within reach of the atmosphere. It is in this state, too, the gnat is provided with small fins on its sides, to enable it to go in quest of food.

After having remained in the state of larva for near twenty days, these insects are transformed into chrysalids, in which all the limbs of the winged gnat are distinguishable through the diaphanous robe with which they are then shrouded. After remaining three or four days

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* Syst. Nat. p. 1002.

wrapped up in this spiral manner, they become gnats, and ascend into a new element. No sooner does the chrysalis reach the surface of the water, than the insect with its head bursts the shell, which then serves it for a boat, of which the wings are the sails. If in this critical moment a breeze arise, it proves to these pigmy sailors a dreadful hurricane; for it oversets the little bark, and the insect not being yet disengaged from it, suffers a fatal shipwreck. If, however, the weather prove calm, the gnat makes a more prosperous voyage: Having time to dry his wings before leaving the boat, he is enabled to mount into the air; where, contemptible as he may seem, he soon becomes the inveterate tormentor of the lords of the creation*.

Culex cinereus †. This species is the most numerous and common; it is called by the *Swedes* Mygg ‡, a name it has also received in some parts of *Britain*. The body is of an oblong shape, and the colour is cinereous. It is this species which, towards evening, is so troublesome to man and other animals. Its efforts are far more feeble and temporary than those of the musquito in *North America*, where the inhabitants are obliged to have their beds close hung with a thin cloth, called Musquito Curtains, to prevent their intrusion.

* Reaumur, Tome IV.

† Fauna Svecica.

‡ Vide Flora Lapponica, p. 363, & Blankner, p. 171.

GENUS VI.—*Empis*.

THE empis is distinguished by that horny substance which forms the proboscis; it is bivalved, inclining downwards under the breast, and is longer than the thorax; the valves are horizontal *. The antennæ of these insects are composed of three articulations; the first is long, the second short and globular, and the third much larger at its base than in the middle; from whence it again grows larger, and is finally terminated by a long sharp point †.

The empis, in its winged state, is seen frequenting flowers; but its manners and residence in its larva and chrysalis state are but imperfectly known to the naturalist.

Empis livida. This species is of a leaden colour; the thorax is gibbous, of a pale green, and marked longitudinally with three black lines: The upper part of the abdomen is dusky brown: and the legs, which are long and hairy, are of a deeper shade of the same colour.

* Lin. Syst. Ord. VI. Gen. vi.

† Barbut, p. 311.

GENUS VII.—*Conops*.

THERE are thirteen different kinds of this tribe enumerated by naturalists, who have distinguished them by a striking character drawn from the rostrum, which is projected, and jointed like the knee. These insects are universally spread; and from their air and general appearance are commonly taken for certain kinds of wasps. They come later in the season than the horse flies, but are much greater tormentors of the horses, were they equally numerous.

Conops vespa. The antennæ of this insect terminate in a broad articulation, like the mouth of a spoon; and which, when closely examined, appears very hairy. The feet and poisers are dun coloured; the thorax is variegated with black and reddish casts of the same colour, which also prevails in the abdomen. These insects are of a large size, and many of them adorned with very vivid and resplendent colours †.

† Vide Barbut, p. 310, 311.

GENUS VIII.—*Afilis*.

THIS tribe is much more slender in the body than the preceding; many of them are superior in length; and they all glow with the most brilliant tints of green, purple, yellow, and brown. The generic characters are, a horny rostrum, porrected, strait, and bivalved †.

These animals are generally found in swampy meadow ground, where, like the preceding tribe, they prove very troublesome to cattle. They are provided with a sting, which inflicts a very painful wound, if you incautiously endeavour to lay hold of them. The proboscis, though sharp enough to perforate the thickest skin, is nevertheless perforated, and supplies the place of a pump, in sucking out the blood of animals.

Inusca crabroniformis ‡, the ferruginous asilis. The thorax is gibbous; the abdomen oval, slender, and tapering §; the three first segments of the abdomen are black, the rest yellow; the feet and wings are of an iron colour. The graziers imagine, and perhaps with justice, that of all the insect tribe, this is the most noxious to black cattle; the very noise of their wings sets them a-running; and before they stop, they generally make their escape into a river, if any is near ¶.

† Syst. Nat. p. 1006.

§ Actes d'Upsal, 1736, p. 29.

‡ Vide Mouffet, p. 46.

¶ Hoffinagel, t. 16.

GENUS IX.—*Bombilius*. *The Buzz Fly*.

THE *British* insects of this genus, in the month of *April*; are seen hovering about the garden flowers, generally in damp situations. Even when in the act of sipping the nectarous dew from plants, they do not settle, but keep constantly buzzing upon the wing. They have no sting, and may be handled with impunity.

The characters of this genus are, a rostrum very long, setaceous, and porrected, formed by two horizontal valves; antennæ which are bent, setaceous, and of a conic form; three stemmata, and two spread wings.

Bombilius medius †. The proboscis of this insect is black, and slender, sometimes divided in two at the extremity, which extends nearly three fourths of the animal's length: the legs are of the same colour, slender, and long in proportion to the size of the insect. The body is short and truncated; the ground colour black, but covered externally with dun coloured tufty down; the wings are unusually long, dark, and dotted with brown ‡.

† Syst. Nat. No. 2.

‡ Barbut, p. 317.

GENUS X.—*Hippobosca*. *The Horse Leech*.

IN the horse leeches, the rostrum is of a cylindrical shape, bivalved, and nodding: the feet are armed with claws; and it is by means of these instruments that they adhere to cattle and horses, in spite of every effort to rub them off. They abound in *New Forest, Hampshire*, and render it a very uneasy pasture for cows. The horse leech is covered with a crustaceous shell, which renders it difficult to be killed, and gives it the air of some species of the bugs.

Hippobosca pedibus pidaclilis, the horse leech with four talons on each foot. This species is but too generally known, from its hostilities against every kind of cattle. It is so tenacious of life, that it will live for a considerable while after the head is cut off. The colour of this hippobosca is wholly grey*. There is a species of these animals with six talons on each foot, which is found in swallows nests; it is much smaller in size, and has the extremity of the abdomen margined†.

* *Ricinus volans* of M. Frisch, p. 43.

† Reaumur, Tome V.

CHAPTER VIII.

SECTION I.

ORDER VII.—*Apterous Insects.*

A MULTIFARIOUS group of animals are comprehended under this order, which are all characterised by the privation of wings in both sexes. All the varieties of crabs and lobsters are introduced by *Linnaeus* into this class of the animal kingdom ; and that with great propriety, because they possess the antennæ, those organs which are peculiarly characteristic of the insect tribes.



GEN. IX.
BOMBYLIUS.



GEN. VIII.
ABILUS.



GEN. X.
HIPPOBOSCA.

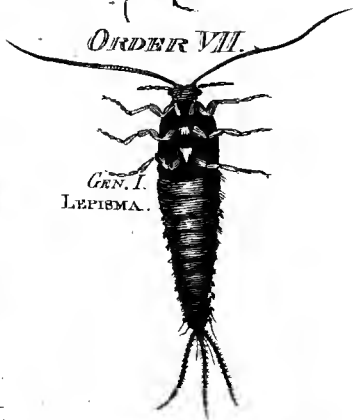


GEN. II.
PODURA.



ORDER VII.

GEN. I.
LEPISMA.



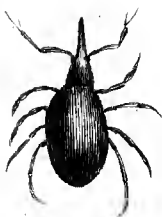
GEN. IV.
PEDICULES.



GEN. III.
TERMES.



GEN. VI.
ACARUS.



GEN. V.
PULEX.



GENUS I.—*Lepisma*.

THE insects of this genus are distinguished by possessing six feet formed for running; a mouth furnished with four palpi; two of which are setaceous, and two capitated. The body is covered with imbricated scales; and the tail is terminated by bristly appendices †.

The residence of the *lepisma* is commonly in gardens and damp houses. In the former, they retreat under mouldy boards or flag-stones; and in the latter, they are seen about window sashes, and old boxes that have remained for some time in a humid situation. When their haunts are disturbed, they make off with so great velocity, that they are but seldom caught; and when that happens, they are often destroyed, being, from their softness, easily crushed.

Lepisma saccharina ‡. The colour of this insect is a shade of lead, brightening into silver: Its most conspicuous member is the tail, which consists of three long threads, slender and fine; but if viewed with a microscope, are covered with tufts of hair. The antennæ of this *lepisma* are long and filiform; in some, they are nearly equal to the length of the body: The feet are six in number, presenting a short and truncated appearance at their insertion: They are received into a groove in the body

of

3 Z 2

† Syst. Nat. Ord. VII. Gen. i.

‡ Syst. Nat. ubi supra.

of the animal, where each has its origin, covered with an oval scale. Towards the tail there are six other appendices, much shorter, which may be termed false feet, as they seem to give no assistance to the progressive motion of the animal *. There are only three species of this genus enumerated in the System of Nature,

* Barbut's Gen. Insect. p. 322.

GENUS II.—*Podura*. *The Springtail*.

THERE are above a dozen of different kinds of the springtail; they derive their *English* name from their habit of bounding from the ground; an exertion which is performed by means of the forked elastic tail which bends under the body, and acts like a spring. The antennæ of the springtails are long and setaceous; their six feet are formed for running; and their eyes are composed each of eight facets †.

Podura villosa, the rough springtail, is a *British* insect, and the largest of the tribe known to us. The ground-colour is dark brown, mixed with a shade of yellow, and variegated all over with streaks of black. The abdomen of this insect alone is smooth, the head being very much covered with hairs, which are so deciduous, that they stick to the fingers on handling the animal; the antennæ, in the subject we saw, consisted of four articulations, and were nearly as long as the body.

This *lepidisma* is generally found below stones; but there are others of the genus that seem purely aquatic, and able to walk and skip upon the surface with apparent ease. It is this species that we may observe in the mornings assembling in pretty numerous tribes upon the banks of stagnated pools. Other species reside among rotten bark, or decayed leaves; and in *Sweden* there is a species which
runs

† Vide *Syst. Nat.* p. 1013.

runs upon the snow, but perishes there as soon as it begins to thaw †.

Podura atra terrestris alba ‡. This species frequents melon beds and hot-houses; where, on watering the ground, numbers are seen jumping into the air like atoms: They are the smallest of the poduræ, and of a white colour.

† De Geer, Actes d'Upsal, 1740, p. 54.

‡ Fauna Swec. Gen. iv.

GENUS III.—*Termes*.

THE discriminating characters of these insects are drawn from the mouth, which is armed with two jaws; from the fetaceous antennæ, and the six feet, which are formed for walking †.

There are only three species of these small insects; to one of which *Linnaeus* has given the name of *Pulfatoria*, from its being supposed to imitate the *ticking* of a watch, by striking its head against the wainscot in the dead of night. This noise, so alarming to some superstitious minds, has been called the *death watch*, and is probably occasioned by the plinus one of the coleopterous insects.

The *termes pulfatorius* varies in its colour according to its residence: When met with in houses, it is commonly of a whitish colour; if found in the fields, as is sometimes the case, it tends more to a brown colour, and is somewhat hairy ‡.

† *Syst. Nat.* p. 1015.

‡ *Barbut's Gen. Insect.* p. 326.

GENUS IV.—*Pediculus*. *The Louse*.

THE characters of this unseemly tribe are, six feet formed for walking; a mouth containing an exerted sting; antennæ as long as the thorax; and an abdomen depressed, and formed of different lobes or segments †.

It is remarkable that almost every animal and vegetable is frequented by its particular louse, although only about fifty different species of this tribe have yet found their way into the systems of natural history. Even man, whose fancied prerogatives lead him to boast of being the lord of the creation, has often the mortification of being trampled upon by the most despicable of all animals.

Pediculus humanus, the human louse. Of this insect there are two varieties; the one inhabits the head, and the other the body. No medical inquiries have yet found out why some families of the same tribe choose these different abodes. Infants and children are most infested with the former of these kinds, and sailors, soldiers, and old men are most liable to be troubled with the latter. Cleanliness is the best antidote against these hideous intruders; and their nauseous society seems a very proper punishment inflicted by nature on its neglect. The phthiasis, or lousy disease, though very little known in latter times, was not unfrequent among the ancients. *Herod*, *Antiochus*, *Calisthenes*, and *Sylla*, with many others, died
of

† *Syst. Nat.* p. 116.

of this disorder. It is uncertain whether this is to be ascribed to their inattention to cleanliness, their scarcity of linen, or their ignorance of the use of mercury. However this may be, there is no person in our climate attacked by these animals, except such as by sloth and nastiness invite their company.

We will spare our readers the trouble of perusing a more minute description of this motly tribe: Such, however, as are not satisfied with their *personal* knowledge; we refer for farther particulars to *Rbedi* *, *Swammerdam* †, and *Bonani* ‡, where they may enjoy an intellectual feast, of which few will envy them.

* Exper. t. 18.

† Quart. 169.

‡ Micogr. f. 55.

GENUS V.—*Pulex*. *The Flea*.

THIS genus consists of two species, which are characterised by six feet formed for leaping; filiform antennæ; a rostrum bent inwards, setaceous, and concealing a sting: The abdomen is laterally compressed, and covered with imbricated laminæ*.

This tribe, like the preceding, is blood-thirsty, and fattens at the expence of the human race. It is said to prefer the more delicate skin of women; but feeds neither upon epileptic persons, upon the dead, nor the dying. Other animals, as well as man, suffer by its intrusions. It nestles in the fur of dogs, cats, and rats; and the nests of the river swallow swarm with them†.

Pulex irritans, the bed flea. In this animal, the antennæ are longer than the thorax; the body of a dark brown colour, and of an oval form; it is apterous, walks but little; but by the elasticity of its legs, can spring above two hundred times the length of its own body. From microscopic observations which have been made upon this animal, it has been found to be oviparous‡. The eggs are deposited on blankets, or among the down of animals; they are round and smooth; and in four or five days, give birth to a very minute worm, which feeds upon greasy fur. After having crept about in this larva-

state

* Syst. Nat. p. 1021.

† Syst. Nat. du Regne Animale, p. 231.

‡ Bonani Microgr. f. 56.

state for a few days, it spins a silken cocoon, in which it lies dormant for about a fortnight ; after which it bursts from its confinement, endowed with powers to disturb the peace of an emperor.

Preparations of mercury are effectual in destroying the flea, and most other noxious vermin. In some places, bugs, fleas, and other abominable insects, are held in superstitious veneration. At *Surat*, there is an hospital endowed for their preservation ; where every night they prevail upon some poor wretch to suffer himself to be preyed upon for their sustenance. They fasten him naked upon a bed, where he is deprived of the means of self defence ; and the famished pensioners riot in his blood during the whole night *. Another pious foundation of a similar nature, but less ludicrous, is erected in *Turkey*, for decayed or infirm dogs.

* Barbut's Genera, p. 332.

GENUS VI.—*Acarus*. *The Tick*.

THE ticks have all eight feet; two eyes, placed one on each side of the head, and two articulated tentacula, in the form of feet *. The tribe contains thirty-five different species, many of which have been inaccurately placed in the genus of lice.

The ticks are all produced from eggs; the females being oviparous. Many of the species of this genus are carnivorous, and prey upon man, as well as other living creatures. When, however, this food is not to be procured, they are capable of deriving their subsistence from plants and vegetables. The dysentery and the itch, two insupportable diseases, are both occasioned by some of the smaller acari insinuating themselves into the human body. In the latter of these complaints, they dig under the skin, and occasion that raging pruriency with which the unhappy patient is afflicted †.

Acarus longicornis is found below stones and the bark of trees. The abdomen and legs are of a red colour; and the whole insect somewhat resembles the shape of a pear. The antennæ resemble those of the scorpion, the articulations being proportionably smaller and more slender; their extremities terminate in a forceps formed by two threads ‡.

Some

* Syst. Nat. p. 1022.

† *Acarus Scabici*, *Actes d'Upsal*, 1736. p. 37.

‡ Frisch, 8. p. 2. t. I.

Some of the acari are well known to frequent cheese; others of them attach themselves to the legs and bodies of bees, spiders, and other insects. The pediculus pubis of *Rhedi*, the cow and sheep louse, seem all to belong to this tribe: The former is engendered, or at least multiplied, by uncleanness upon the pudenda, where it is more vexatious than the louse*.

The monocolus, or arborescent water flea, may also be added to the tribe of acari †. This insect, when viewed with the assistance of the microscope, appears to have but one eye; for, on account of the smallness of the head, the two seem to be joined together. When you view them with a lens, however, both appear, and are of a reticulated structure. Its trunk then also is seen, small, sharp, and transparent.

This insect is of a blood red colour; and its numbers, that float on the surface of stagnated water, are sometimes so great, that they give it the appearance of blood. *Swammerdam* mentions an instance in which the people of *Leyden* were greatly alarmed by this colour of the water, deeming it portentous of some great calamity.

* *Rhedi* *Expof.* t. 12.

† *Swammerdam*, *Quart.* p. 66.

GENUS VII.—*Phalangium*.

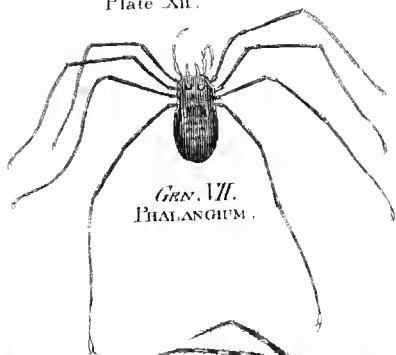
THE insects of this family bear a strong resemblance to the crab: They have eight feet, and four eyes; two on the summit of the head, and two on the sides. The antennæ are fixed to the fore part of the head, and have the appearance of feet; the abdomen is round*.

Some have imagined that all those threads with which the grass and stubbles in autumn are covered, are the production of the phalangia. So numerous are these threads, that in the course of one day the whole surface of the ground is covered with them. Their uses to the animal are probably to ensnare its prey, and to assist it in travelling through the air. Other naturalists have supposed these waving threads to be spun by a species of tick called the autumnal weaver.

Phalangium opilio, the shepherd weaver. The body of this species is round; above, the colour is a dusky brown; below, a dirty white. The legs are uncommonly long, and slender: when caught by one of them, the owner parts with it to save his body, and makes off without any apparent uneasiness: This is also the case both with the crab and lobster, whose loss is quickly repaired by the growth of a new limb. No experiments have yet ascertained whether the power of reproducing their limbs may not also belong to the insects of this genus.

* Syst. Nat. p. 1027.

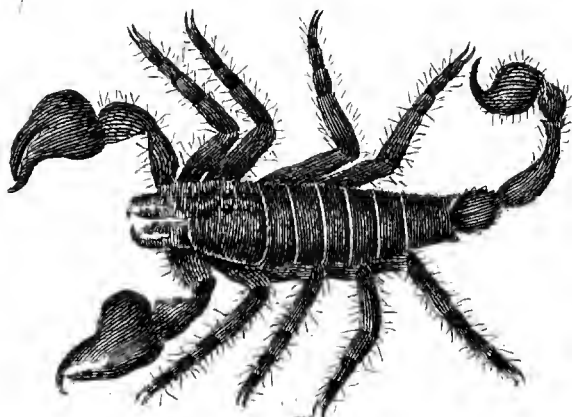
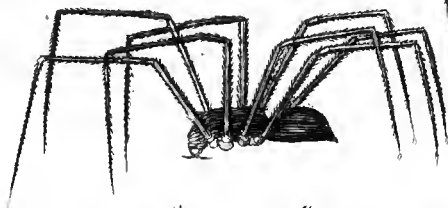
Plate XII.



GEN. VII.
PHALANGIUM.



GEN. VIII.
ARANEÆ.



GEN. IX.
SCORPIO.



GENUS VIII.—*Aranca*. *The Spider*.

THE insects of this family may be considered as a kind of *Arguses*, all possessing eight eyes, and distinguishable into families by their arrangement and position. They have eight feet, and a mouth armed with crotchets. The instruments for spinning are shaped like nipples, and placed in the anus.

But the circumstance by which the spiders are most distinguished, are the two articulated palpi, which are headed by the genitals of the male in that sex †. As the spiders prey upon each other, except during the time of their amours, they dare not venture within reach of each other, but with the utmost caution. They are then seen stretching out their legs, shaking their webs, and tampering with each other, by a slight touch with the extremity of the feet; then, in a fright, dropping hastily down their threads, and returning in a few moments to make a fresh trial by feeling. When once both parties are well assured of the sex they have to deal with, the approaches of their feet to feel become more frequent, confidence takes place, and the instant of amorous dalliance ensues ‡.

We cannot, says *Lyonnet*, sufficiently admire how careful these animals are, not to give themselves up blindly to a passion, or venture upon an imprudent step, which might prove fatal to them. After the male and female
spider

† *Syst. Nat.* p. 1030.‡ *Barbut*, p. 339.

spider have thus met, it is asserted by the most accurate observers, that the extremity of the claws of the former opens, by a kind of spring, and lets out a white substance, which he applies beneath the abdomen of the female, and thus accomplishes the great purpose of nature †.

In this country, where all the insect tribes are kept under by the coldness of the climate, or by human assiduity, the spiders are small in size, and comparatively few in number: Here, they are an inoffensive, as well as a humble tribe; but in the warmer regions of *Africa* and *America*, they are hideous and terrible. There, the spiders, as well as all the insect tribe, acquire a size and a vigour, which to the inhabitants of the north of *Europe* must appear incredible. The abdomen of the *Mar-tinico* spider is as large as a hen's egg, and covered all over with hair: Its web is strong; and its bite is dangerous. Happy it is for us, that we are placed at such a distance from these animals, that we can study their history without dreading their resentment.

The eyes are placed all around the head; they are immoveable, and destitute of eyelids, but are sort tied with a transparent horny substance, which at once protects and assists their vision. A number of eyes so unusual among the rest of animated beings, seems to have been deemed necessary to an insect destined to procure its support by the most watchful attention. The mouth of the spider is equally fitted for his occupation: It consists of two serrated pincers, which spring from the forehead, and terminate like the claws of a cat. A little below the point of the claw there is a small hole, through which the animal

† Lyonnet and Lister.

mal emits a poison ; which, though harmless to us, is capable of instantly destroying its prey.

But all these arms of the spider, formidable as they are, would prove insufficient for procuring him subsistence, did he not add stratagem to force. Every one is acquainted with his invention of spreading a net for the fly, an insect which, without this artifice, must for ever have escaped him. The position of the spider's web is generally well chosen ; being placed either in the corners of rooms, the sides of windows, or among the branches of trees, where flies are most frequent and plenty.

For the construction of this delicate engine, Nature has supplied these animals with a large portion of a glutinous substance, which she has granted them the power of spinning into a thread so delicate, that ninety of them twisted together are only equal in thickness to that of the common silk worm. Every thread of the common spider's web, though scarcely visible by the naked eye, is composed of a vast number of slender filaments joined together. The instruments of this delicate operation are five dugs or teats, with small orifices, capable of being contracted or dilated, according to the fineness of the intended thread.

After the net has been thus formed, the next care of its owner is to provide a proper retreat, from which he may survey the whole, and observe the success of his own artifice. Some threads being in contact with his body, whenever the web is touched from without, he instantly feels the motion, and accordingly prepares either for attack or defence. If the insect invading his territories prove a fly, he immediately sallies forth, and devours the devoted prey with all that ferocity which distinguishes

the lion or the tiger. If, however, the assault be committed by an enemy stronger than himself, the spider keeps close concealed in his fortress; and it is not till the danger is over, that he ventures forth to repair the damages which his property has sustained.

By such accidents, as well as the force of the wind, the labours of many days are often instantly destroyed; and either the construction of a new web, or a repair of the old, becomes absolutely necessary. Here the spider has again recourse to that glutinous substance with which he was originally provided. The life of this animal seems chequered with misfortunes. The time seldom fails to arrive, when the reserves of gluten, by repeated draining, become entirely exhausted; and the poor spider is left to all the chances and vicissitudes of want, which often bring him to an untimely end*.

The natural longevity, however, of the spider, is greater than seems to have been granted to the generality of the insect tribes. The length of his life is not exactly ascertained; but it probably endures for several years. The female, it is said, does not begin to lay her eggs till she has completed her second year; and even then, her brood is not so numerous as when she has attained her full maturity. When that period arrives, she has been known to produce near a thousand eggs in a single season. The eggs being thus deposited, the animal prepares a silken bag for their reception, till they are hatched. Thus packed up, she glues them to her body, by means of the same adhesive matter with which the web is spun; and

* Goldsmith's Nat. Hist. Vol. VII.

in this manner they are carried by the parent, like another body attached to her own.

With all this tenderness for its young, there is no animal more ferocious, or more powerfully armed for destruction than the spider: It can destroy insects far above its size; and its indiscriminate rapacity does not even spare those of its own kind. *Reaumur*, when he endeavoured to turn the labours of different insects that spin silk to the advantage of man, was foiled in all his attempts to domesticate the spider. He provided them with a habitation, and with every kind of food, flies, and blood in the ends of unripe feathers, a morsel of which they are particularly fond: but all was in vain; their malignant nature rendered them unfit for society, and turned them from their food to destroy each other. By perseverance, however, he obtained as much of the silk intended for the covering of their eggs, as enabled him to manufacture a pair of gloves of these curious materials.

Aranca hortensis. This species frequents the garden trees, among the branches of which it spins its web, and stations itself in the centre. The body is of a brownish colour; the eyes very small, and of a violet purple†. With the silk of this spider *M. Bon* of *Languedoc* contrived to manufacture a pair of silk stockings, of a fine grey colour, and in strength and elegance nearly equal to those of common silk.

Aranca domestica. This species inhabits windows and unfrequented apartments; it is oblong, and of a brown colour; the abdomen black. This animal has four ca-

† Lister, Aran. 83.

vities upon the back, by which it may easily be distinguished †. Between the nails of the feet there issues a clammy liquor, by which it is enabled to climb up glass and other smooth surfaces. The web of this species is constructed of much finer threads. It is said to possess six muscular nipples, each having a thousand orifices for letting out the threads ‡. If this be true, each filament of the spider's web must consist of six thousand threads, which, when united, are scarcely visible to the naked eye.

To this tribe is commonly referred the tarantula, the the largest spider known in Europe; but rendered still more remarkable by the extraordinary qualities which credulity has ascribed to it. It is three quarters of an inch in length, the body covered all over with down, generally of an olive dusky brown. The external parts resemble those of the rest of the genus: It has eight eyes and as many legs; the front armed with ferrated pincers.

The bite of the tarantula is said, but without foundation, to be attended with fatal consequences. After violent pains and sickness, the unhappy victim is seized with an involuntary laughter; dances without intermission, exhibiting all the symptoms of insanity. At the return of the season in which he was bit, the patient's madness begins again to appear; and these troublesome relapses, after having recurred for several years, at last terminate in death.

Music and dancing, as the fiction proceeds, is the only remedy for this dreadful malady. The musician begins to play a tune famous for the cure, slow at first, but increasing

† Fauna Svecica.

‡ Vide Reaumur, Ba-but, and Goldsmith.

creasing in quickness as the patient seems affected. After continuing this ridiculous, but violent exercise, till a profuse perspiration is brought on, the imaginary venom is forced from the system, and the cure is completed. Such were the reputed effects of the bite of the tarantula, till travellers of discernment traced the whole fiction to the artifice of the peasants of *Apulia*, who, for a small sum had been in the habit of allowing themselves to be bitten, and then counterfeited madness, to astonish the wondering multitude.

GENUS IX.—*Scorpio. The Scorpion.*

WE are now to contemplate the manners of an animal, the most hideous, and perhaps the most formidable of the insect tribes. There are six different species of the scorpion, distinguished by their size and colour, and the countries where they reside. Happily for *Britain*, none are found there, but a species no bigger than a louse; and even that is extremely rare †. In *Italy*, *Spain*, and the south of *France*, they are frequently to be met with three inches in length, and are considered as the greatest pests that torment mankind. But the size and malignity of the scorpions of *Europe* may be deemed trifling, when compared with that of the *African* monsters that are distinguished by that name. Along the *Gold Coast* they are sometimes found larger than a lobster, and their sting is inevitably fatal ‡. From the language of Scripture, too, we find that in the east these animals have long been formidable to mankind. In *Batavia*, they sometimes grow twelve inches in length; and in removing furniture, behind which they skulk, there is the utmost danger of being stung.

The genus of scorpions is characterised by eight eyes, three of which are placed on each side of the thorax, and
two

† Barbut's Gen. Inf. p. 351.

‡ Bosman's Travels.

two almost contiguous upon the back. Besides eight feet, they have two palpi, each armed at the extremity with a forceps. The tail is lengthened out by different articulations, the last terminating in a sharp and crooked sting.

Scorpio Afer. This terrible and venomous animal is an inhabitant of *Africa*: Its colour is a deep glossy brown; the segments of which the body is composed, each terminate in a band of bright yellow; while the two eyes sparkle in the back like diamonds. Its appearance bears a strong resemblance to the lobster. Most of the travellers who have visited *Africa* represent this animal not only as poisonous, but exceedingly irascible; and the effects of its resentment, unless speedily relieved, become fatal †.

It is to *M. de Maupertuis* that the public is indebted for the first accurate and philosophical account of these animals. According to him, they are all viviparous; the body of the pregnant female exhibiting, when opened, between forty and fifty living young. Each of these is separated from the rest by a thin membrane, while all are united by a common filament. In order to ascertain the venom of their sting, that philosopher bred a great number together, and let them loose upon dogs and other animals; and he found that sometimes the sting was so empoisoned as to swell the whole body of the wounded animal; and in that case it brought on violent retching, convulsions, and death. At other times, whether from the difference of food, or some other cause, he found their sting harmless.

The

† Leba and Moore.

The common food of the scorpion are worms, flies, and spiders. The *Italian* scorpion, when inclosed with the latter animal in a glass bottle, exhibits a dreadful combat, which terminates in favour of the scorpion. After having stung his adversary to death, he cuts off his limbs with his claws, and then sucks the juice from his body †. No observations nor experiments of naturalists have yet enabled them to assign the cause why the sting of the scorpion, which at one time is fatal, proves harmless at another; nor has the medical art yet found out any certain antidote against its malignity. The efficacy of the oil of scorpions, and some other remedies that are used, is perhaps rather to be ascribed to want of activity, or the total absence of the poisonous matter.

† Ephemer. Dec. II. 1687. Observ. 224.

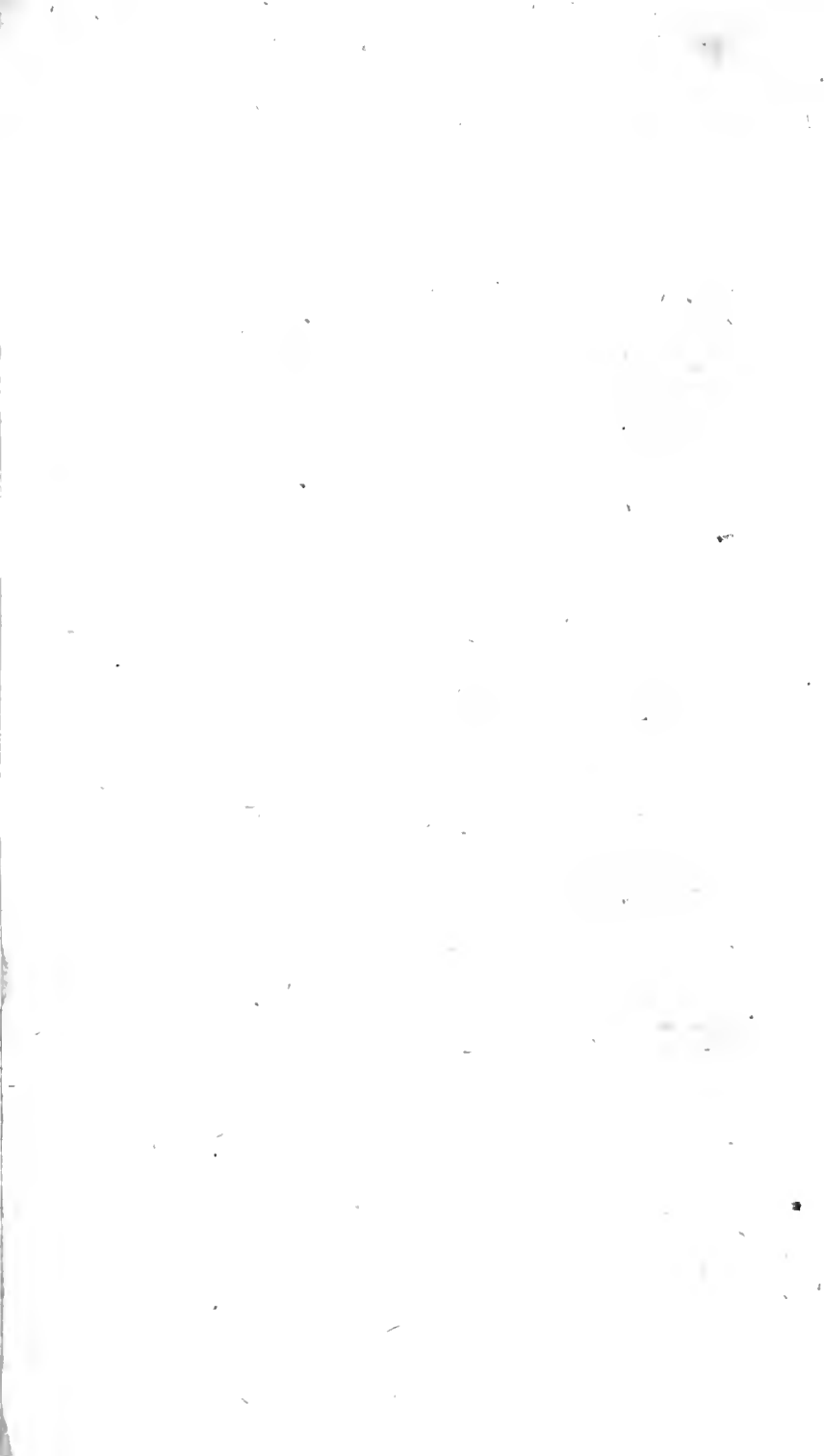
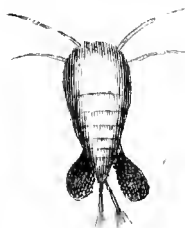


Plate XIII.

GEN. X.
CANCR.



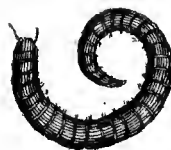
GEN. XI.
MONOCULUS.



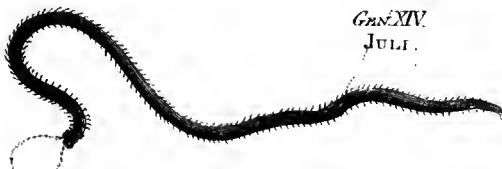
GEN. XII.
ONISCI.



GEN. XIII.
SCOLOPENDRA.



GEN. XIV.
JULI.



GENUS X.—*Cancer*. *The Crab*.

AFTER the example of *Linnaeus*, we place the crab among the insects, because it is possessed of some of the invariable characters of this class of beings. All the eighty-seven different species of crabs are distinguished in possessing two members performing the office of hands, and terminating each in a forceps. They have generally eight feet, and two moveable eyes, projecting from the head, or placed upon a pedicle or stalk. The two palpi are armed with claws; the tail is articulated, and unarmed.

In general, the crabs are aquatic animals, whose residence is in the sea: Some, however, are known to frequent rivers; and in *America*, there are some species wholly terrestrial; these are commonly about four inches long, and feed upon leaves. The liquid substance found in their shell cures the blisters that are raised on the skin by the milky substance that exudes from the mancellina tree. The savages apply the fat, when melted down, as a specific against the rheumatism†.

Cancer Bernardus, the St. Bernard or hermit crab. This species is small in size, and semicrustaceous. As it has no scales to defend it, it takes up its dwelling in the empty shells found lying upon the shore. Of these it tries various kinds, till at length one is pitched upon,

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† Barbut's Gen. Inf. p. 358.

fitted to its shape and size : the increase of its bulk, however, soon forces it to exchange this for a different and more capacious habitation ; again, therefore, it sallies forth in quest of a new mansion. Should it meet with another crab engaged in the same pursuit, they frequently are seen quarrelling for the same shell. This battle, *pro aris et focis*, often proves obstinate, till the vanquished sneaks off ; and the empty apartment becomes at last the prize of the victor. Of the house thus obtained, they are so tenacious, that nothing but heat will disengage them from their retreat. When caught, they pinch forcibly, and utter a faint cry.

Cancer cursor. This animal has obtained its name from the nimbleness with which it runs. It is amphibious, leaving the sea towards noon, and parading upon the shore ; from which, however, it speedily makes its retreat on the approach of danger †.

The common lobster belongs to this genus, the species of which are far more numerous than naturalists have yet allowed. This animal is so well known, that a description of it can hardly be necessary. It is found all around the shores of *Britain*, frequenting particularly the stony ground, where it is caught by a creel or willow-work of a particular construction, that admits of its entering, but precludes any return. The bait by which it is enticed into this prison is fish guts.

Every lobster is supposed to be self impregnated, and to exhibit an example of an hermaphrodite of the most perfect kind. The ovary where the spawn is first produced, lies towards the tail, and is filled with that red substance,

† Barbut, *ubi supra*.

substance, each particle of which is the embryo of a future animal. When they are first excluded from the belly, they are placed under the tail, where the parent animal protects them from danger, till they acquire limbs and animation. In that state, they drop off into the water, when yet very small, and betake themselves to the crevice of a rock for shelter, till they are enabled by greater strength to search for their prey. When full grown, their voracity is so merciless and indiscriminate, that they mutually devour each other.

The lobsters, like all other insects, possess antennæ, and like these animals change their external covering once a-year: To them, this is a painful and tedious operation. The lobster continues growing, while its crust continues unalterably the same: hence it soon becomes too large for its habitation, and is necessitated to get free. During their transformation, all their vigour and activity ceases; and they no sooner feel its approach, than they betake themselves to some retired situation, where they may be safe from the attacks of their enemies. The claws, and even the stomach, are said to be changed in this convulsive effort of nature. Before casting the shell, the animal throws itself upon its back, strikes its claws against each other, and every limb seems to tremble; its feelers are agitated, and its whole body is in violent motion. It then swells itself in an unusual manner, and at last the shell is seen beginning to divide at its junctures, particularly at the belly, where it was least firmly united †.

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† Goldsmith's Nat. Hist. Vol. VI. p. 363.

In this painful manner does the lobster attain its liberty ; but so feeble is its condition, that it remains for hours motionless, from the fatigue of the operation. Many die in this violent crisis of their existence : Such as survive keep close to their dens for several days, shunning danger with all the timidity of worms, whose softness and imbecility they then acquire.

GENUS XI.—*Oniscus*.

THIS is a diminutive, but harmless tribe of animals: They are distinguished by having fourteen feet, setaceous antennæ, and the body of an oblong form. *Linnaeus* has enumerated fifteen species, some of which are terrestrial, and others aquatic †.

Oniscus aquaticus. This insect is found in wells and stagnated pools ‡. The body is composed of seven articulations, besides the head and tail; the last is much larger than any of the rest. The shape of the animal is flat and round: From each side there spring seven feet, each growing longer as you approach the tail ||.

The sea onisci are larger than those of the fresh water, having ten instead of seven segments. Their motions in the water are rapid; for besides the feet, they are assisted by lateral threads, which push them forward like the oars of a boat. Among them, copulation endures for several days; when the male seizes his female with his two fore feet, and drags her along with him wherever he directs his course; and nothing can induce him to leave his female till this operose function is discharged. A few days after impregnation, the female discovers a distended belly; on the seventh, the young issue alive from her

† *Systema Nat.* p. 1059.

‡ *Rai Inf.* p. 43.

|| *Regne Animale*, p. 250, sp. 4.

her womb, and swim around with alertness and animation.

All this while, the male, it is said, continues fixed upon his female, not for the purpose of fecundation, but of assisting her to cast her slough; a good office; in which he is not successful till he has exerted the whole of his strength.

On her first appearance after leaving her coat, the female is entirely white; her slough, of a deep ash-colour, is left floating upon the surface, and so entire, that you would imagine it to be the real animal. This transformation being completed, the male leaves his female, and unassisted undergoes a similar change.

Oniscus domestica. This insect inhabits damp houses and walls, and must have been seen by every person. The upper part of the body is dark brown, the belly grey. Two varieties of this animal are found in the fields, having each, like it, the body divided into ten segments, exclusive of the head and tail. The latter part terminates in two appendices*. The land onisci are all supposed to be oviparous, while the aquatic produce living young. For some time after being excluded from the shell, the former are often of a pale red colour. The domestic oniscus is gathered for medicinal purposes†.

* Charleton Exercit. 54.

† Vide Barbut, p. 365.

GENUS XII.—*Scolopendra*.

THIS tribe has in the *Latin* language obtained the name of *mille-pes*, from the extraordinary number of feet with which nature has provided some of its species; one kind of the scolopendra having no less than an hundred on each side. In general, the feet of these insects are as numerous as the segments into which their bodies are divided. They have the antennæ setaceous, articulated palpi, and the body depressed or flattened †. Of this hideous race there are eleven different species, distinguished by their form, size, and colour. Some live beneath the bark of decayed trees, or are found below stones and garden boxes; others inhabit the fresh and salt water, and are all remarkable for their quick progressive motion.

Scolopendra forficata. The feet of this species are fifteen on each side; the last longer than the rest, and turning backwards, form a forked tail. The body is of a dun colour, smooth, and composed of nine scaly segments, without reckoning the head ‡.

The marine scolopendra || in form somewhat resembles the leech; it builds those small edifices of a brittle and porous texture which are seen upon the shore at low water. These masses are composed of a number of small funnels,

† Syst. Nat. p. 1062.

‡ Barbut's Gen. Inf. p. 367.

|| Vide Rai Inf. p. 44.

funnels, each having the aperture closed up with a covering of sand, to protect the inhabitant from danger.

In the *East Indies* and *America*, there are scolopendræ from four to six inches long, and as thick as the finger: When of that bulk, they appear truly hideous, and their sting is reckoned as dangerous as that of the scorpion. Some of these animals are said to be without eyes, and to direct their course by means of two feelers that extend beyond the head. It has been asserted, too, that when cut into pieces, each segment, like those of the polypi, is capable of reproducing an entire animal*.

* Barbut, ubi supra.

GENUS XIII.—*Tulus*.

THIS tribe so nearly resembles the former, that in the Fauna Swecica they are both included under one genus. The feet of the tuli are still more numerous than those of the scolopendra, being, on each side, twice as many as the segments of the body. The antennæ are moniliform, the palpi articulated, and the body of a semicylindrical form.

Tulus fabulosus *. This species has no less than two hundred and forty feet, although its length is not more than an inch. It is of an ash-colour, and smooth; the body composed of sixty segments, each giving off two pair of small white feet. The antennæ of this insect are short, and consist of five rings. When the animal is touched, it wraps itself up into a round ball, the feet all turned inward.

Millepeda orientalis †. This is the largest of all the tuli, being as long and as thick as a man's finger: The head is small, and obtuse, the antennæ clavated, and the eyes black; the body is of a pale colour, and divided in forty-three segments, each having a pair of feet on every side, the whole amounting to an hundred and seventy-two ‡.

* Rai Inf. p. 47.

† Seba, I. p. 131.

‡ Regne Anim. p. 253. sp. 3.

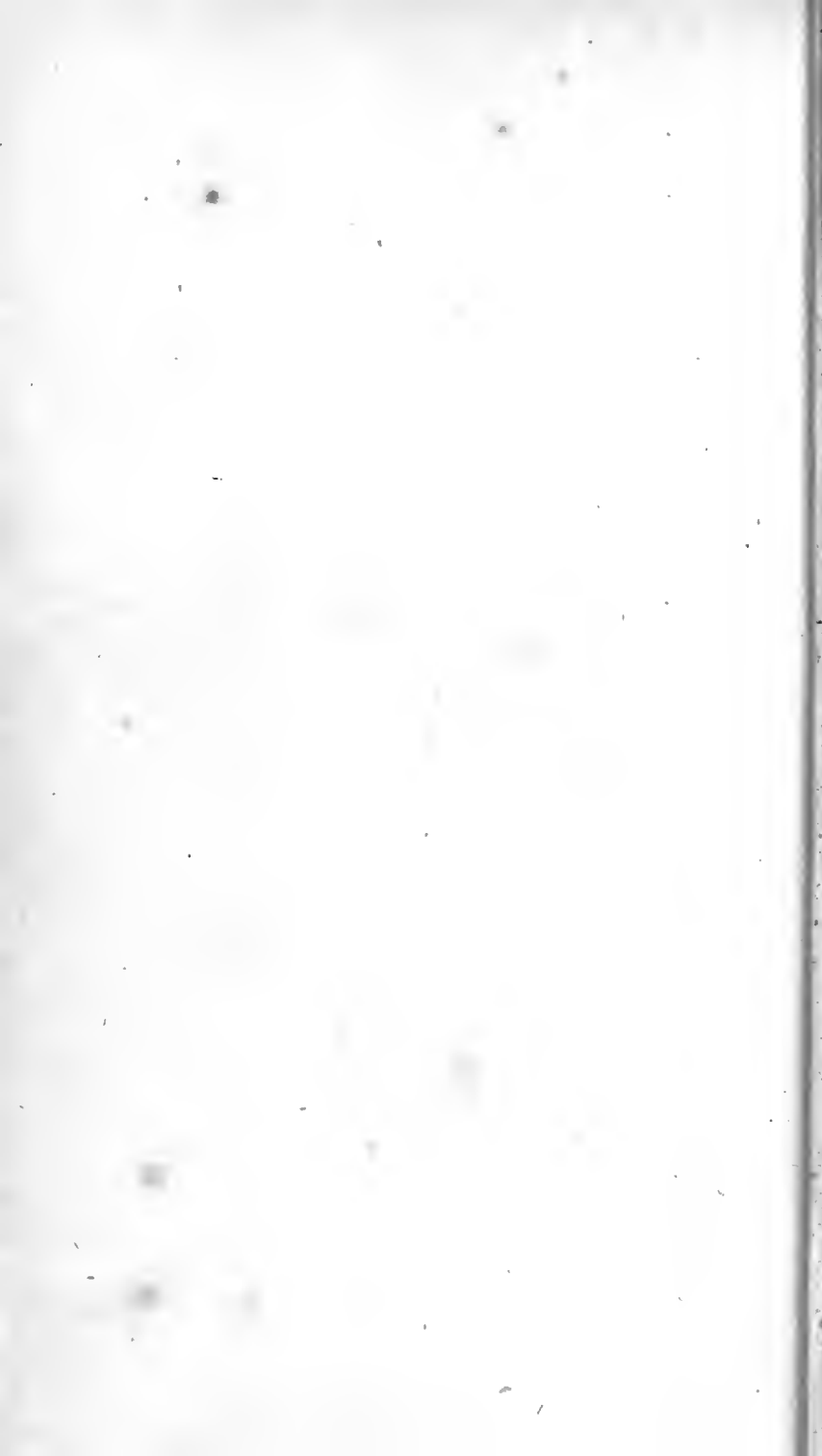
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